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CRYOGENIC PROPELLANT FLUID PROPERTIES  
FINAL REPORT FOR DATA EVALUATION PROGRAM  
ON  
GOVERNMENT ORDER H-76797

by

*N6719907*

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Report to

Propulsion and Vehicle Engineering Laboratory  
Materials Division  
George C. Marshall Space Flight Center  
National Aeronautics and Space Administration

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#### NOTICE

This report on NBS Project 3150422 was prepared under Government Order H-76797 entitled "Cryogenic Propellant Fluid Properties Data Evaluation Program," for the George C. Marshall Space Flight Center of the National Aeronautics and Space Administration. This work was administered under the technical direction of the Propulsion and Vehicle Engineering Laboratory, Materials Division of the George C. Marshall Space Flight Center with Mr. Harold Perkins, R-P&VE-MCA, contracting officer's technical representative, acting as project manager.

#### ABSTRACT

This report summarizes the work accomplished under NASA-MSFC, Government Order H-76797. Included are the compilations of thermodynamic properties of oxygen, thermodynamic properties of argon, viscosity and thermal conductivity of argon, viscosity of oxygen, and viscosity of nitrogen. This report includes new tables of thermodynamic properties of oxygen from 55 to 300°K with pressures at 0.1, 0.4, 0.7, 1, 4, 7, 10, 40, 70, 100, 200, and 300 atmospheres. Also included are new tables for the viscosity and thermal conductivity of gaseous argon from 100 to 2000°K, viscosity of gaseous oxygen from 100 to 2000°K, and viscosity of gaseous nitrogen from 100 to 2000°K.

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1.0 INTRODUCTION

The Data Compilation Unit of the Cryogenic Data Center is engaged in the critical evaluation of thermophysical property data from the scientific literature for materials at cryogenic temperatures. The objective is the compilation of extensive tables of property values over wide ranges of temperature and pressure. This project is a part of the total program of this Unit in which specific tasks have been undertaken which are of interest to the sponsoring agency. These tasks and the progress made under this contract on each task are listed individually in the following sections of this report.

Of the several tasks which were in progress as a part of this project, some are continuations of tasks which were initiated under previous projects. Other tasks were initiated in the terms of this project. In some instances, the task has been only partially developed to date, and will be continued under other project funding. The following outline of an evaluation task is included as a guide to the status of each task which is reported in the remainder of this report.

1.1 Data Compilation Procedures

Upon the initiation of tasks for data compilation, a bibliography is prepared by the Cryogenic Data Center's Documentation Unit. A systematic and comprehensive search of the abstract journals on the subject is then made and appropriate items added to the bibliography. Copies of all documents in the bibliography are procured which are in turn searched for additional references related to the subject. Following the compilation of the bibliography, the numerical data and pertinent facts related to it are extracted from the literature and compiled on data sheets which are assembled in task notebooks. Related data are then compared and evaluated on appropriate statistical and theoretical bases. Using the experimental data from the literature and appropriate theoretical and empirical techniques, comprehensive data tables over extended ranges of temperature and pressure are compiled.

The task is concluded by the publication of a document which describes the data evaluation procedures, and the methods used in generating data tables; also included are comprehensive data tables and appropriate graphical representations. In addition to the final publication, various interim reports and documents may be issued. These interim documents include the bibliographies resulting from the literature search, compilations of the data extracted from the literature which may be prepared from the task notebooks, and interim tables of property values which may be calculated prior to the final analysis and evaluation of the data. The purpose of these interim publications is to make this material available to the sponsoring agency, prior to the completion of the specific task.

2.0 THERMODYNAMIC PROPERTIES OF OXYGEN

The task for the compilation of thermodynamic property data of oxygen was initiated under a previous project. Under this previous project, a bibliography of documents containing information of thermophysical properties of oxygen at low temperatures was published, as NBS Tech. Note No. 137 [1]\*. Interim tables of thermodynamic property data were also issued as NBS Report No. 7922 [2]. Under this project, evaluation of the oxygen data was continued, incorporating new P-p-T data for oxygen and obtaining an improved equation of state for the properties of oxygen from which a new table of thermodynamic data has been prepared. As a part of the evaluation of the oxygen data, particular emphasis was also given to establishment of the uncertainties of the tabulated data. Tables of thermodynamic properties are given in the appendix. The work summarized here on the compilation of the thermodynamic properties of oxygen is described in detail in reference [26A].

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\* Numbers in brackets refer to items in the list of references given in the bibliography.

### 2.1 P-ρ-T Data

The principle source of P-ρ-T data used in this compilation is by Weber [3] in the Cryogenics Division of the National Bureau of Standards. This source includes 1154 data points with temperatures from 80 to 300°K and pressures to 340 atmospheres. The complete analysis of these data by the experimenter has not been completed, therefore, these data must be regarded as preliminary values. However, in this compilation, these data have been compared with other data in the published literature, and estimates of the uncertainties of the P-ρ-T values calculated by the equation of state have been determined. The other sources of the P-ρ-T data that were used in this compilation are listed in Table I.

TABLE I - SUMMARY OF P-ρ-T DATA USED FOR FITTING EQUATION (1)

Number of Points	Temperature Range (°K)	Pressure Range (atm)	Source
75	156 to 233	20 to 61	Kamerlingh Onnes and Kuypers (1924) [4]
43	120 to 233	2.8 to 9.3	Nijhoff and Keesom (1925) [5]
4	273	0.4 to 1	Baxter and Starkweather (1926) [6]
40	273 to 323	22 to 134	Michels, Schamp, and de Graaff (1954) [7]
1154	80 to 300	6 to 340	Weber (1965) [3]
68	64 to 90	2 to 149	van Itterbeek and Verbeke (1960) [8]
15	77, 90	98 to 874	van Itterbeek and Verbeke (1961) [9]

### 2.2 Selection of "Best Values"

The initial evaluation of the several data sets was a comparison of the experimental data with values calculated from a preliminary equation of state. This analysis was also used, in part, to ascertain the relative precision of the various data sets. The data sets selected for the development of a final equation of state are listed in Table I. Not included are the older data sets at ambient temperatures, since the newer measurements of Michels et al. [7], and Weber [3] adequately define this region.

A comparison of the liquid P-ρ-T data was made for the data sets by Weber [3], van Itterbeek and Verbeke [8], [9], and Timrot and Borisoglebskii [10]. This comparison showed that the data by van Itterbeek and Verbeke, and by Weber were in agreement within the precision of these data sets. However, the density values by Timrot and Borisoglebskii were smaller in the corresponding ranges of temperature by from 0.3 to 0.6 percent. Because of these differences, the data of Timrot and Borisoglebskii were not used to determine the equation of state.

The published measurements of densities of saturated liquid were observed to be less precise than the selected data in the single phase regions. It was assumed that more accurate saturated liquid and saturated vapor data could be determined by an extrapolation of the equation of state to the vapor pressure than could be determined from the direct measurements of the saturation states. Therefore, the saturation liquid data were not included in the fit to the equation of state. Comparisons of the saturated liquid data with the equation of state are illustrated in figure 7.

Corrections for temperature scale differences were applied to the experimental data where appropriate. These corrections reduced the reported temperatures for all data sets to a common Kelvin scale based on 273.15°K as the ice point and 90.18°K as the oxygen point.

### 2.3 Equation of State

The equation of state developed for oxygen is,

$$\begin{aligned}
 P = & \rho RT + (n_1 T + n_2 + n_3/T^2 + n_4/T^4 + n_5/T^6)\rho^2 \\
 & + (n_6 T^2 + n_7 T + n_8 + n_9/T + n_{10}/T^2)\rho^3 \\
 & + (n_{11} T + n_{12})\rho^4 + (n_{13} + n_{14}/T)\rho^5 \\
 & + \rho^3(n_{15}/T^2 + n_{16}/T^3 + n_{17}/T^4)\exp(n_{25}\rho^2) \\
 & + \rho^5(n_{18}/T^2 + n_{19}/T^3 + n_{20}/T^4)\exp(n_{25}\rho^2) \\
 & + \rho^7(n_{21}/T^2 + n_{22}/T^3 + n_{23}/T^4)\exp(n_{25}\rho^2) \\
 & + n_{24}\rho^{n_{28}+1}(\rho^{n_{28}} - \rho_c^{n_{28}})\exp[n_{26}(\rho^{n_{28}} - \rho_c^{n_{28}})^2 + n_{27}(T - T_c)^2]
 \end{aligned} \quad (1)$$

The coefficients of the equation of state,  $n_1$  through  $n_{28}$ , are given in Table II. These coefficients were determined by a weighted least squares fit of the input experimental data. In this least squares fit, constraints for the critical point were imposed upon the equation of state using the methods outlined in the paper by Hust and Stewart [11]. These constraints are listed in Table III, the fixed points and conversion factors used are listed in Tables IV and V, respectively. Weight factors used in the least squares fit were defined as in reference [11]. This method expresses the weight factors as a function of the variances of the measured quantities. However, these variances were not determined for the individual measured quantities. It is reasonable to assume that the errors in the measurement of pressure and temperature are small as compared to errors in density. Therefore, the weight factors were determined from the variances of the densities only. The variance was taken as the square of the uncertainty of the densities. The uncertainties in the densities estimated by the experimenter were used for the data by Weber [3]. The estimated uncertainties in the data by Van Itterbeek and Verbeke [8,9] were based on the deviations between these two sets of data, as illustrated in figure 3. The uncertainties in the data by Baxter and Starkweather [6] were estimated from the precision indicated by their tabulated sets of data. The uncertainties in the other data sets were estimated from the random deviations as indicated by the density deviations illustrated in figures 4, 5, and 6. These estimated uncertainties of the experimental density data are listed in Table VI.

Equation (1) is a modification of the equation of state used by McCarty and Stewart [12] for neon. The function associated with  $n_{24}$  was added to allow the equation of state to fit the selected critical point. The best fit of the data to an equation of state which did not include this function suggested the form of the correction required to fit the selected critical point. This additional function was, therefore, added with the values of  $n_{26}$  and  $n_{27}$  determined for a density range extending from 8 to 21 g mol/liter and for a temperature range from 152 to 158°K. The contribution of this function to the equation of state is illustrated in figure 8.

The accuracy with which the equation of state fits the experimental data is illustrated in figures 1 to 7. Figure 1 gives the deviations of the equation of state from selected isotherms of the data by Weber [3]; and figure 2 gives the deviations from the isotherms at near the critical point. The pressure deviations from Weber's data near the critical point are also illustrated in figure 2, and indicate the difficulty of further improvements in the equation of state in this area. Figure 3 illustrates density deviations for two sets of data by van Itterbeek and Verbeke [8,9], as well as a comparison of corresponding isotherms from Weber's data. This figure illustrates the excellent agreement of these alternate data sources, as well as the representation of these data by the equation of state (1). Figures 4, 5, and 6 illustrate corresponding comparisons of other data sets; again the agreement is within the precision of the data with the exception of the isotherms approaching the critical point in figure 5. Figure 7 gives the density deviations of saturated liquid data from the equation of state (1), and indicates that these data are not as precise as the measurements in the single phase states.

#### 2.4 Vapor Pressure Equation

Based on Hoge's [13] comparisons and an examination of more recent data, the data presented by Hoge were selected as the most accurate measurements of the vapor pressure of oxygen. The selection of the vapor pressure equation to represent these data is described in the report by Hust and Stewart [14]. This equation is,

$$\ln P = a_0 + a_1 T + a_2 T^2 + a_3 T^3 + a_4 T^4 + a_5 T^5 + a_6 T^6 + a_7 T^7. \quad (2)$$

The coefficients of this equation were determined by weighted least squares fit to Hoge's experimental data. Equation (2) was constrained to the triple point, normal boiling point, and critical point. The weight factors for Hoge's experimental data were determined according to the methods outlined in reference [11]. The coefficients for the vapor pressure equation are listed in Table VII.

#### 2.5 Critical Point Density

The critical point density was determined as the isochor having a slope  $(\partial P / \partial T)_p$  equal to the slope of the vapor pressure curve  $(dP/dT)$  at the critical point. The slope of the vapor pressure at the critical point was determined from equation (2). The equation of state (1) was used to calculate the slope of the isochors  $(\partial P / \partial T)_p$  along the critical isotherm. The density of the isochor with a slope equal to the slope of the vapor pressure curve  $(dP/dT)$  at the critical point was determined to be 13.333 g mol/liter.

#### 2.6 Derived Thermodynamic Properties

The entropy, enthalpy, and internal energy of the gas phase, including the saturated vapor, were calculated with equations (3,4,5) respectively, with the derivatives  $(\partial P / \partial T)_p$  from equation (1). Tables of thermodynamic properties of oxygen are given in the appendix.

$$S(T, p) = S_{T_0}^o + \int_{T_0}^T C_P^o \frac{dT}{T} - R \ln(RTP) + \int_0^p \left[ \frac{R}{p} - \frac{1}{p^2} \left( \frac{\partial P}{\partial T} \right)_p \right]_T dp \quad (3)$$

$$H(T, \rho) = H_{T_0}^0 + \int_{T_0}^T C_P^0 dT + (Z - 1)RT + \int_0^\rho \left[ \frac{P}{\rho^2} - \frac{T}{\rho^2} \left( \frac{\partial P}{\partial T} \right)_\rho \right] T d\rho \quad (4)$$

$$U(T, \rho) = H(T, \rho) - P/\rho \quad (5)$$

The reference entropy of the ideal gas at  $T_0 = 55^\circ K$  and one atmosphere,  $S_{T_0}^0 = 155.7168 J/^{\circ}K g mol$ , was obtained from Hilsenrath et al. [15]. The reference enthalpy of the ideal gas at  $T_0 = 55^\circ K$ ,  $H_{T_0}^0 = 1590.929 J/g mol$ , was obtained from the values of  $H^0 - E_0^0$  listed by Hilsenrath et al. [15] by taking  $E_0^0$  to be zero.

The zero pressure specific heat,  $C_P^0$ , as tabulated by Hilsenrath et al. [15], was represented by equation (6) between 20 and 2000°K with an average deviation of 0.005 percent and a maximum deviation of 0.025 percent.

$$C_P^0/R = a/T^3 + b/T^2 + c/T + d + eT + fT^2 + gT^3 + hu^2e^u/(e^u - 1)^2 , \quad (6)$$

where  $u = i/T$ . Coefficients for equation (6) are given in Table VIII.

The saturated liquid entropies and enthalpies were determined by subtracting the entropy and enthalpy changes due to vaporization as given by the Clapeyron equation (7) from the saturated vapor values.

$$\Delta H = T \Delta S = T \frac{dP}{dT} \Delta V \quad (7)$$

The difference between the volume of the vapor and the liquid at saturation is designated by  $\Delta V$ . The saturated liquid and vapor densities were determined by the simultaneous solution of the vapor pressure equation (2) and the equation of state (1). The slope of the vapor pressure curve  $dP/dT$  was obtained from equation (2).

The liquid entropies and enthalpies were determined by calculating the isothermal changes from saturated liquid states with equations (8,9), respectively, with the derivative  $(\partial P/\partial T)_\rho$  obtained from equation (1).

$$\Delta S = \int_{\rho_{sat}}^\rho \left[ -\frac{1}{\rho^2} \left( \frac{\partial P}{\partial T} \right)_\rho \right] d\rho \quad (8)$$

$$\Delta H = \frac{P}{\rho} - \left( \frac{P}{\rho} \right)_{sat} + \int_{\rho_{sat}}^\rho \left[ \frac{P}{\rho^2} - \frac{T}{\rho^2} \left( \frac{\partial P}{\partial T} \right)_\rho \right] d\rho \quad (9)$$

TABLE II - COEFFICIENTS FOR EQUATION (1)

T in °K, P in atm, ρ in g mol/liter

$R = 0.0820535$	$n_{10} = -3.59419602 \times 10^{-10}$	$n_{19} = -2.67817667 \times 10^2$
$n_1 = 3.38759078 \times 10^{-3}$	$n_{11} = 1.02209557 \times 10^{-6}$	$n_{20} = 1.05670904 \times 10^5$
$n_2 = -1.31606223$	$n_{12} = 1.90454505 \times 10^{-4}$	$n_{21} = 5.63771075 \times 10^{-3}$
$n_3 = -7.38828523 \times 10^3$	$n_{13} = 1.21708394 \times 10^{-5}$	$n_{22} = -1.12012813$
$n_4 = 1.92049067 \times 10^7$	$n_{14} = 2.44255945 \times 10^{-3}$	$n_{23} = 1.46829491 \times 10^2$
$n_5 = -2.90260005 \times 10^{10}$	$n_{15} = 1.73655508 \times 10^2$	$n_{24} = 9.98868924 \times 10^{-4}$
$n_6 = -5.70101162 \times 10^{-8}$	$n_{16} = 3.01752841 \times 10^5$	$n_{25} = -0.00560$
$n_7 = 7.96822375 \times 10^{-5}$	$n_{17} = -3.49528517 \times 10^7$	$n_{26} = -0.157$
$n_8 = 6.07022502 \times 10^{-3}$	$n_{18} = 8.86724004 \times 10^{-1}$	$n_{27} = -0.350$
$n_9 = -2.71019658$		$n_{28} = 0.90$

TABLE III - CONSTRAINTS IMPOSED ON EQUATION (1)

$$\begin{aligned} P-\rho-T \text{ at the Critical Point} \\ \left\{ \begin{array}{l} P = 50.14 \text{ atm} \\ \rho = 13.333 \text{ g mol/liter} \\ T = 154.77^\circ\text{K} \end{array} \right. \end{aligned}$$

$$\begin{aligned} (\partial P/\partial \rho)_T &= 0 \text{ at the Critical Point} \\ (\partial^2 P/\partial \rho^2)_T &= 0 \text{ at the Critical Point} \\ (\partial P/\partial T)_\rho &= dP/dT \text{ from Equation (2) at the Critical Point} \\ &= 1.928386 \text{ atm}/^\circ\text{K} \end{aligned}$$

TABLE IV - FIXED POINT DATA

Critical Pressure	50.14 atm
Critical Temperature	154.77°K
Critical Density	13.333 g mol/liter
Normal Boiling Temperature (IPTS, fixed point)	90.18°K
Density Saturated Vapor at nbp, equation (1)	0.1396 g mol/liter
Density Saturated Liquid at nbp, equation (1)	35.65 g mol/liter
Triple Point Pressure	0.00150 atm
Triple Point Temperature	54.353°K
Density Saturated Liquid at Triple Point, equation (1)	41.3 g mol/liter
Density Saturated Vapor at Triple Point, equation (1)	0.0003364 g mol/liter

TABLE V - CONVERSION CONSTANTS

1 atmosphere	$= 1.01325 \times 10^5$	Newton/meter <sup>2</sup>
1 joule	$= 9.86896 \times 10^{-3}$	liter-atm
1 calorie	$\approx 4.1840$	joules
1 g mol oxygen	$= 31.9988 \text{ g}$	(based on the C <sup>12</sup> = 12.000 scale)

TABLE VI - ESTIMATED UNCERTAINTIES OF THE EXPERIMENTAL DENSITY DATA

Data Source	Estimated Uncertainty in Density (percent)
Kamerlingh Onnes and Kuppers [4]	0.30
Nijhoff and Keesom [5]	0.15
Baxter and Starkweather [6]	0.0025
Michels, Schamp, and de Graaff [7]	0.03
van Itterbeek and Verbeke [8]	0.15
van Itterbeek and Verbeke [9]	0.15
Weber [3] (early experiments)	0.05
Weber [3] (later experiments)	0.03

TABLE VII - COEFFICIENTS FOR VAPOR PRESSURE EQUATION (2)

$a_0 = -6.25967185 \times 10^0$ $a_1 = 2.47450429$ $a_2 = -4.68973315 \times 10^{-2}$ $a_3 = 5.48202337 \times 10^{-4}$	$a_4 = -4.09349868 \times 10^{-6}$ $a_5 = 1.91471914 \times 10^{-8}$ $a_6 = -5.13113688 \times 10^{-11}$ $a_7 = 6.02656934 \times 10^{-14}$
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TABLE VIII - COEFFICIENTS FOR ZERO PRESSURE SPECIFIC HEAT EQUATION (6)

$a = -1.86442361 \times 10^2$ $b = 2.07840241 \times 10^0$ $c = -3.42642911 \times 10^{-1}$ $d = 3.50297163$ $e = 2.05866482 \times 10^{-7}$	$f = -1.11035799 \times 10^{-8}$ $g = 2.08612876 \times 10^{-11}$ $h = 1.01894691$ $i = 2.23918105 \times 10^3$
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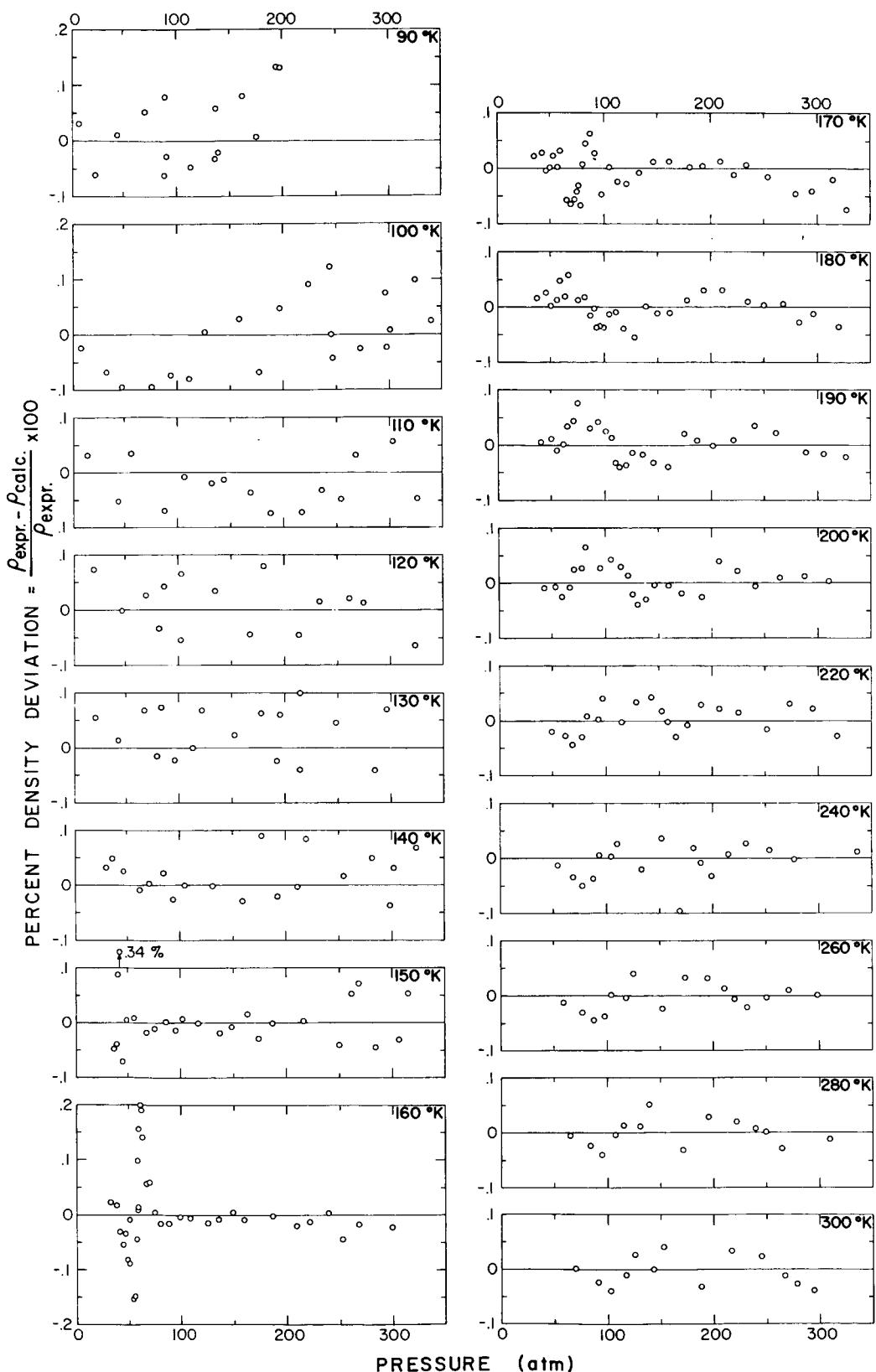


Fig. 1. Density deviations of selected isotherms from the data by Weber [3] from the equation of state (1).

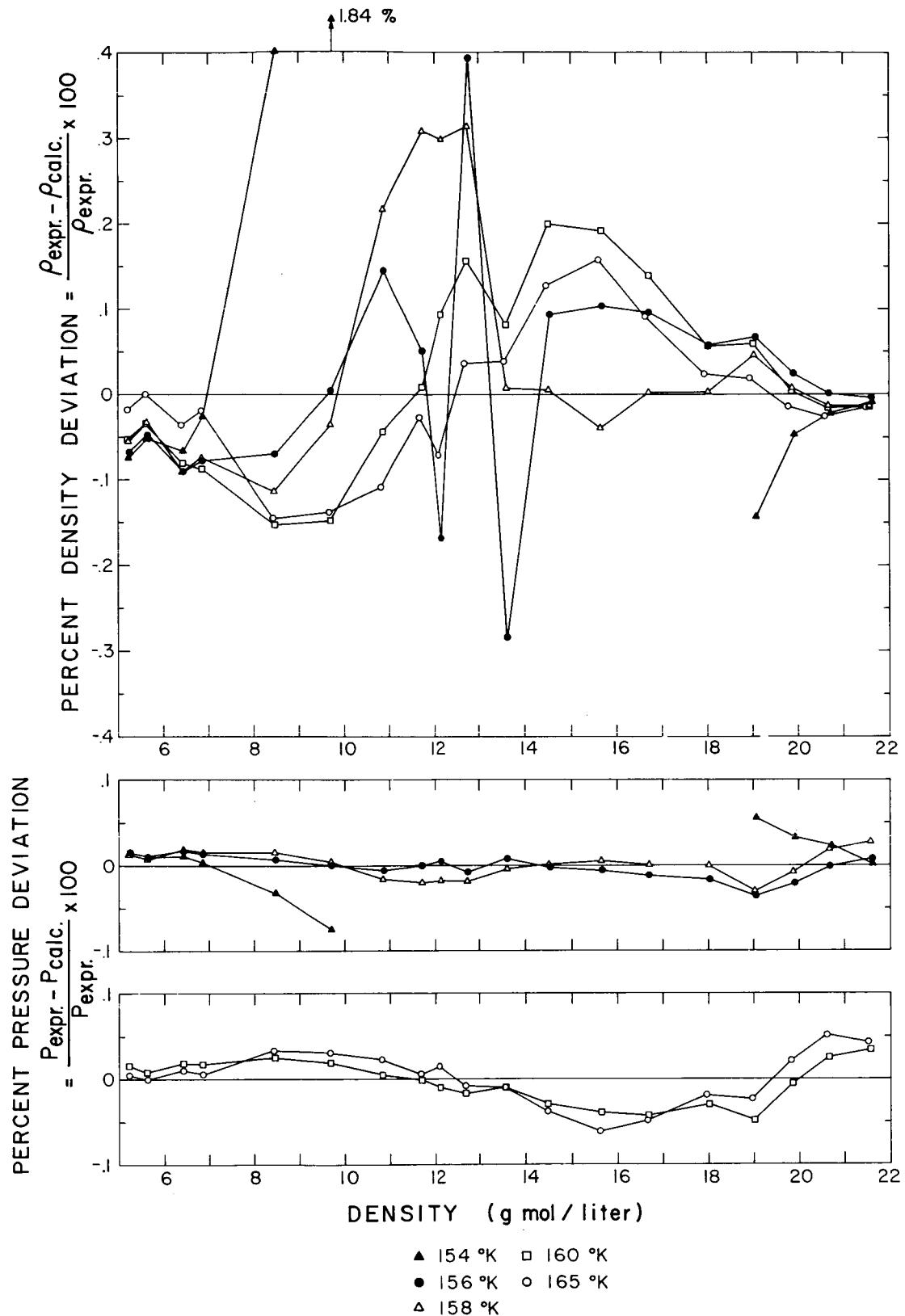
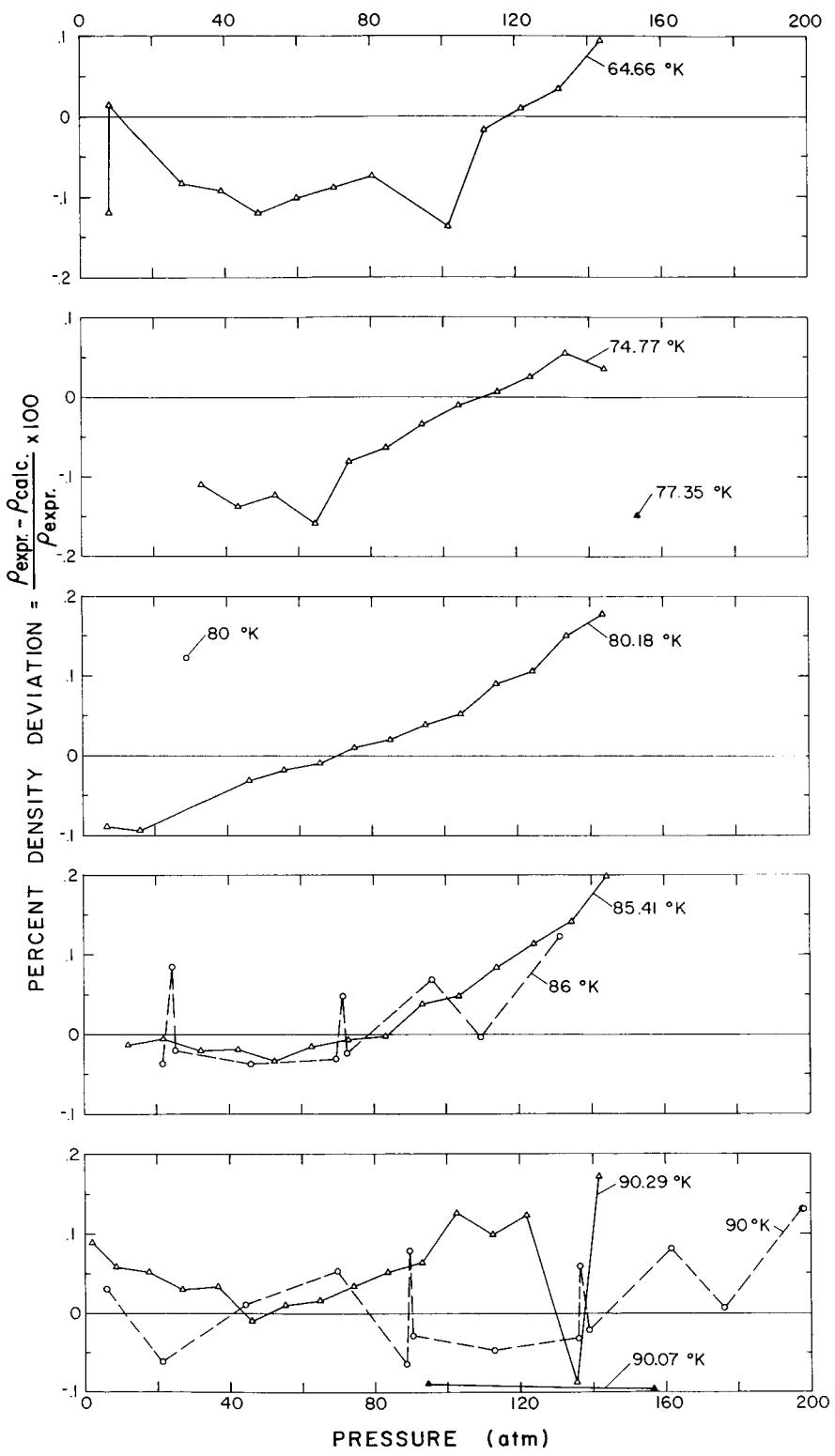


Fig. 2. Density and pressure deviations of isotherms near the critical point from the data by Weber [3] from the equation of state (1).



$\triangle$  Van Itterbeek and Verbeke (1960) [8]  
 $\blacktriangle$  Van Itterbeek and Verbeke (1961) [9]  
 $\circ$  Weber [3]

Fig. 3. Density deviations of data by van Itterbeek and Verbeke [8,9] from the equation of state (1), and comparison with data by Weber [3].

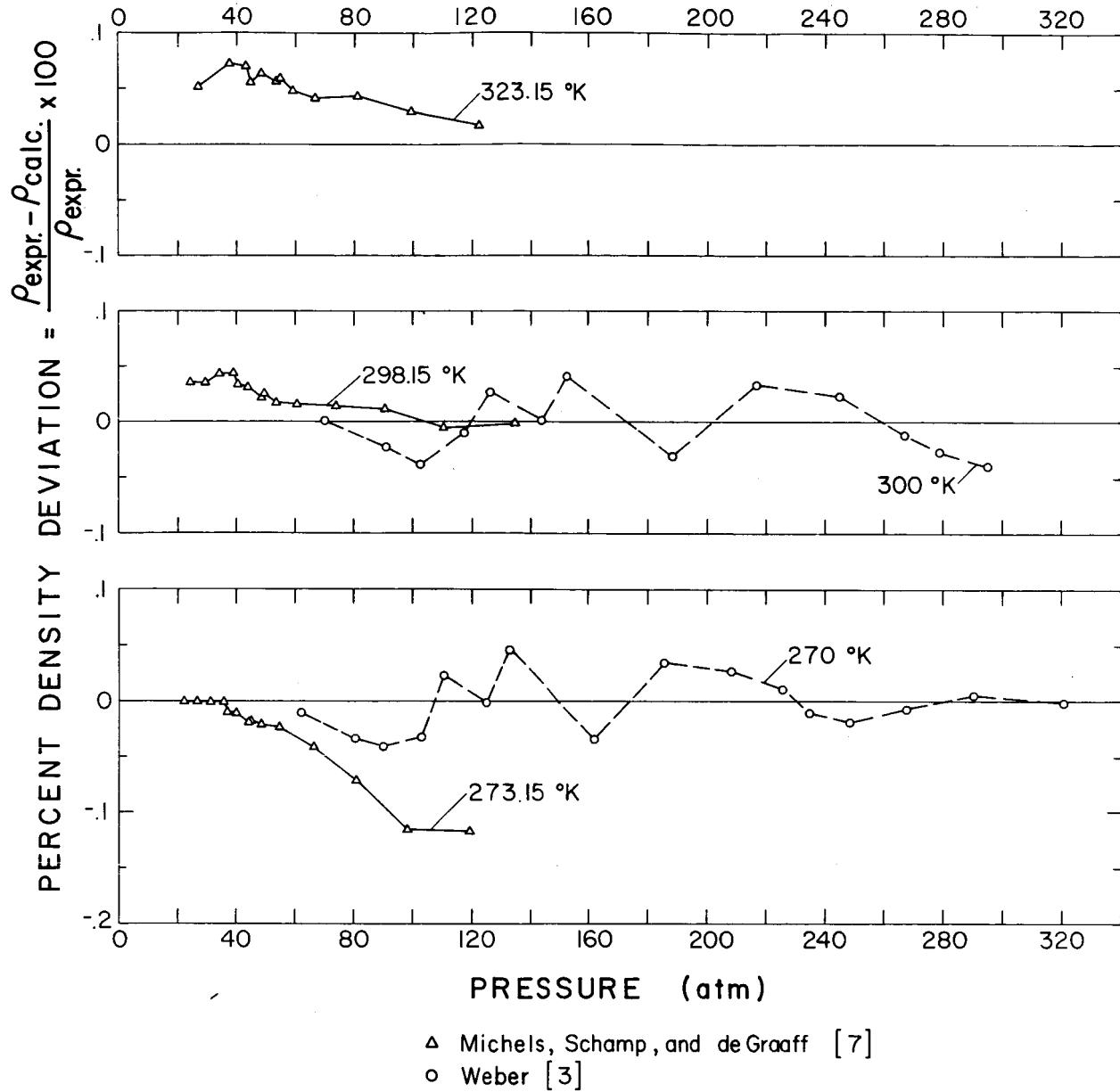


Fig. 4. Density deviations of data by Michels, Schamp, and de Graaff [7] from the equation of state (1), and comparison with data by Weber [3].

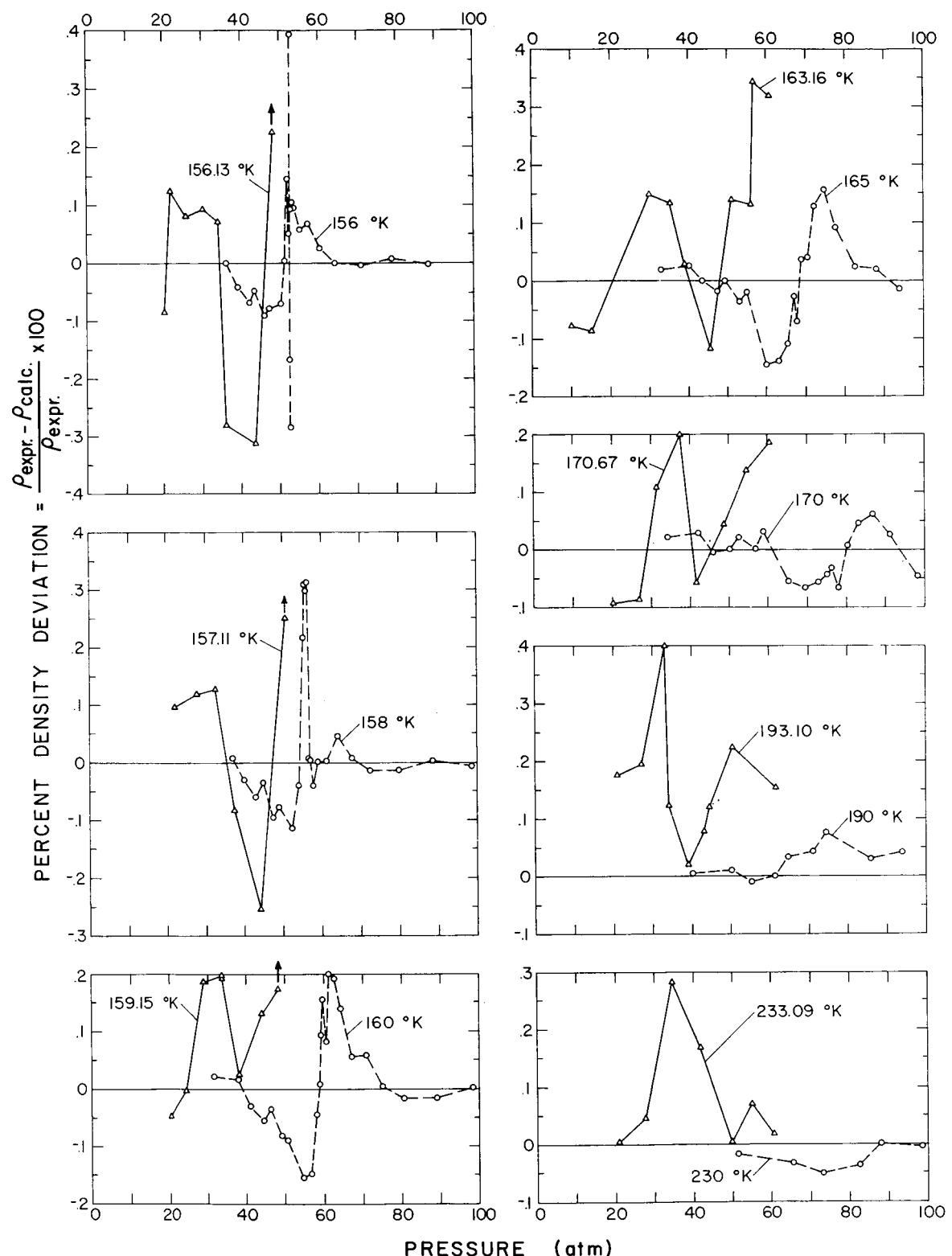


Fig. 5. Density deviations of data by Kamerlingh Onnes and Kuypers [4] from the equation of state (1), and comparison with data by Weber [3].

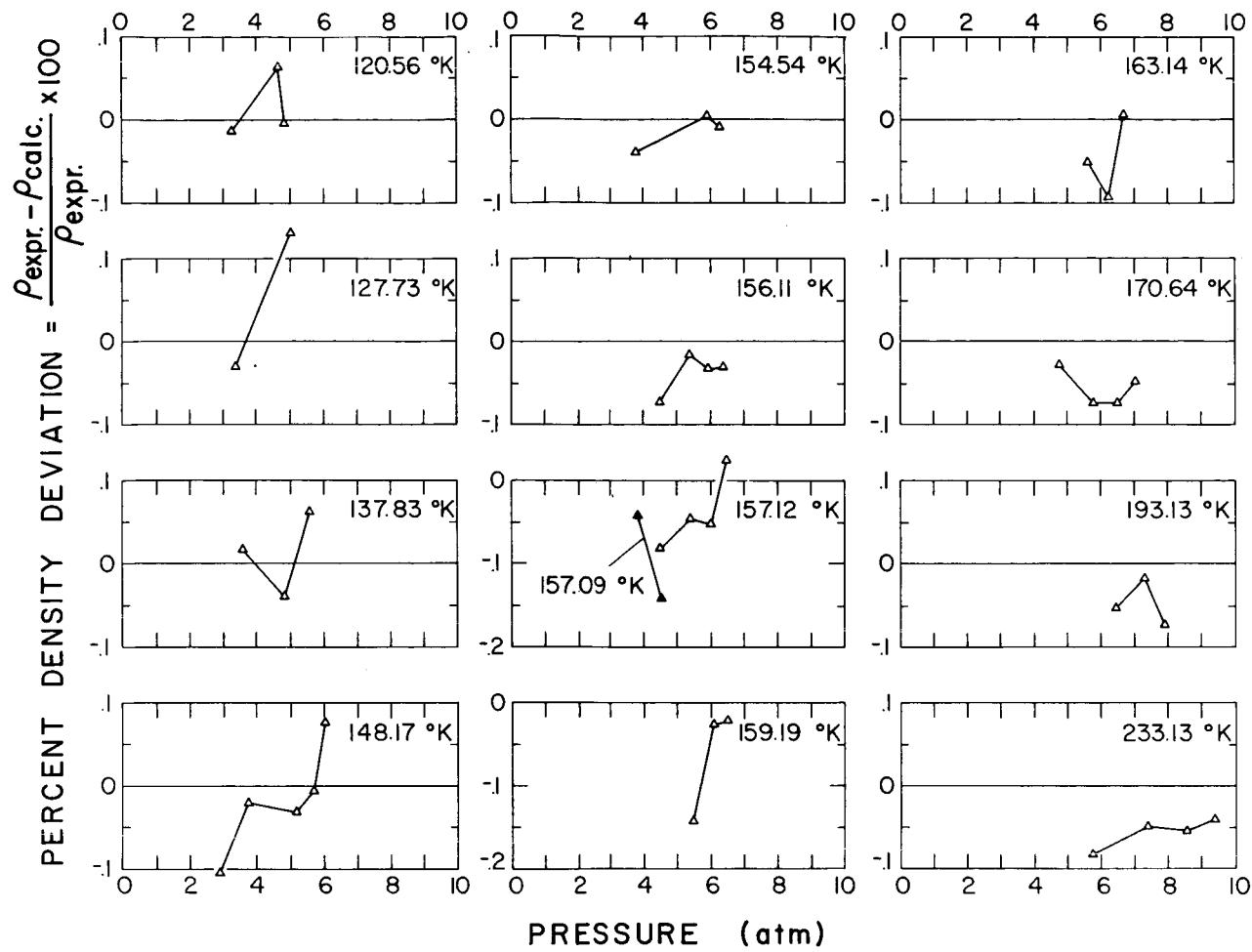
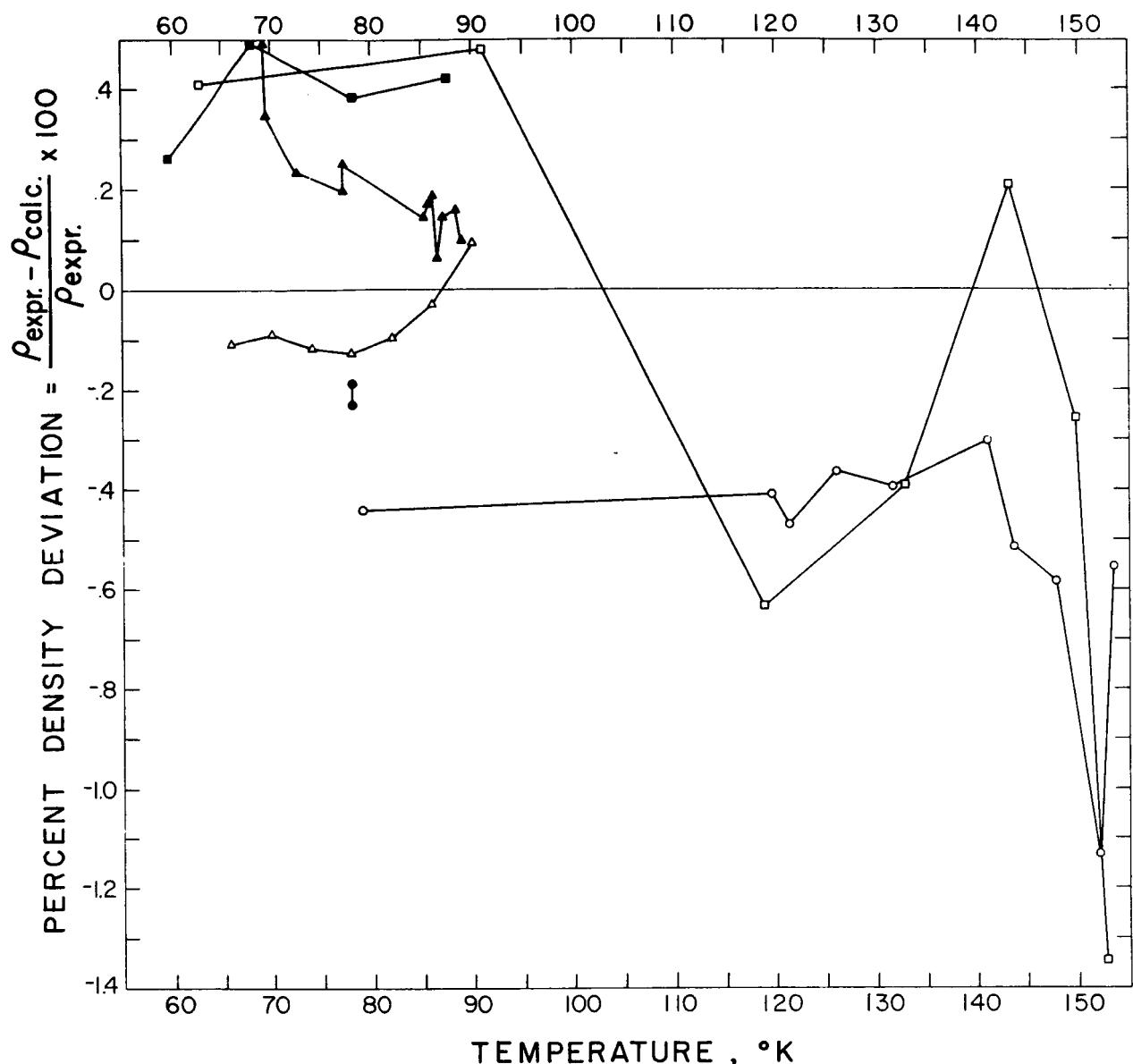


Fig. 6. Density deviations of data by Nijhoff and Keesom [5] from the equation of state (1).



- Timrot and Borisoglebskii (experimental values) [10]
- Blitz, Fischer, and Wunnenberg [22]
- △ Van Itterbeek and Van Dael (by extrapolation) [23]
- ▲ Baly and Donnan [24]
- Mathias and Kamerlingh Onnes [25]
- Kanda [26]

Fig. 7. Density deviations of saturated liquid data from the equation of state (1).

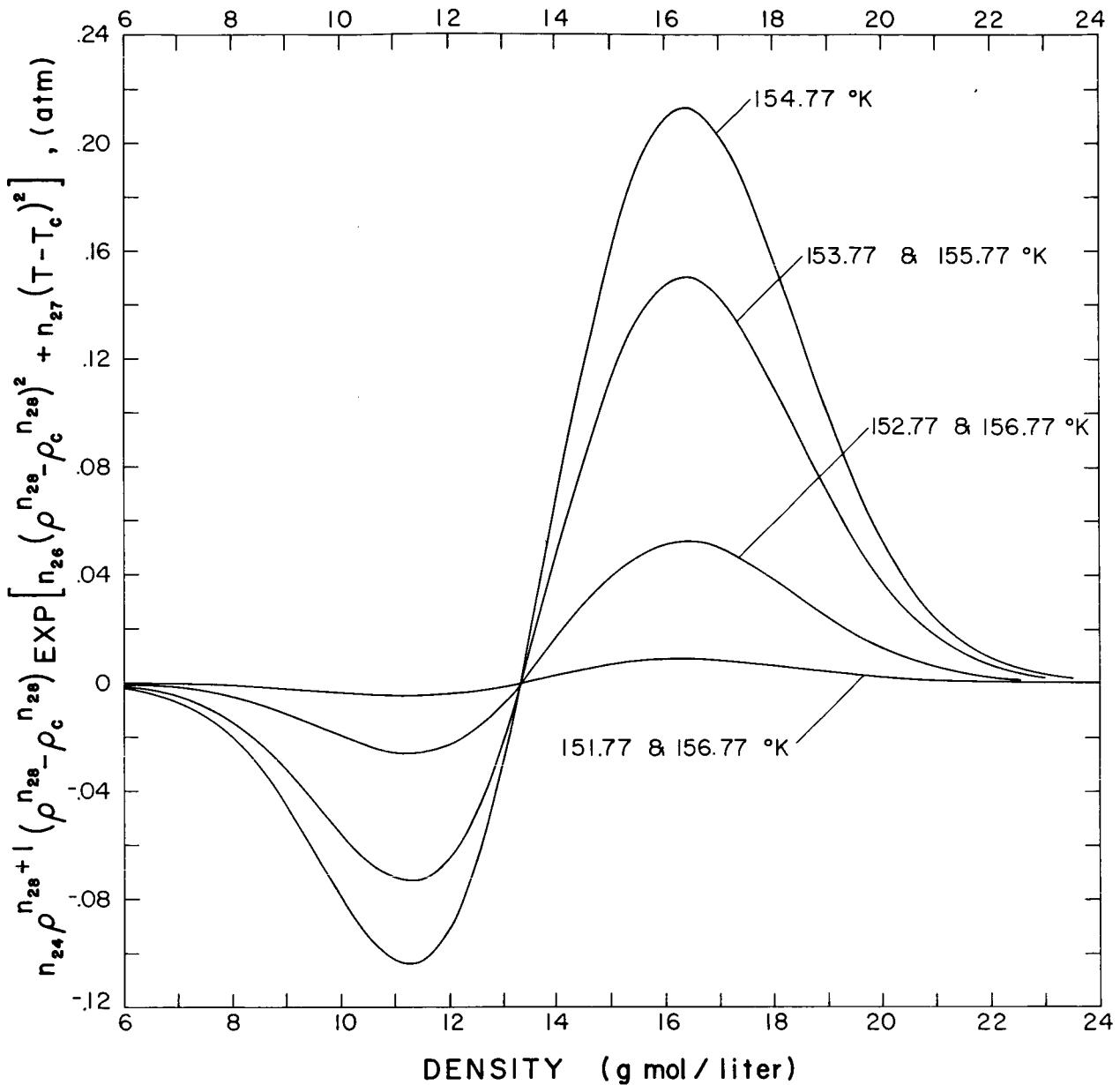


Fig. 8. Function added to equation of state (1) to improve the fit near the critical point.

### 3.0 THERMODYNAMIC PROPERTIES OF ARGON

The task for thermodynamic property data for argon is assigned to a summer employee. This task was also the subject for his Ph.D. Dissertation [16]. This dissertation includes a recalculation of the thermodynamic property tables that were issued in NBS Report 8293 [17]. This new calculation includes more accurate values in the liquid range, and in particular, in the vicinity of the critical point. Copies of these new thermodynamic property tables for argon may be obtained by writing to Professor J. Merle Trummel, Department of Mechanical Engineering, State University of Iowa, Iowa City, Iowa.

This project was active again during the summer of 1965. The study was continued to evaluate new high pressure liquid data, and to extend the compilation of the thermodynamic properties in the liquid phase to the melting line. The compilation was also extended to lower temperatures, and the saturated solid and vapor data at low pressures were included in the compilation down to 20°K. This task will be active again during the summer, 1966, during which time a manuscript will be prepared which will report all of the results of this project and present extensive tabulations of the thermodynamic properties together with new temperature-entropy diagrams for argon.

#### 3.1 Extension of Property Tables to 20°K

The thermodynamic properties of argon along the saturated solid and saturated vapor lines have been compiled by Ziegler, Mullins, and Kirk [18]. This compilation has been reviewed, and comparisons of the saturated vapor volumes have been made with values calculated by the equation of state determined by Gosman [16]. The specific volumes along the saturated solid line have been recalculated, using the information from the literature which was the source of the information used in reference [18]. The saturated solid specific volumes that have been determined by a recalculation present a smoother change in this property with temperature than the values reported by Ziegler. A comparison of the specific volumes of the saturated vapor and the saturated solid for temperatures from 80 to 20°K is given in Table IX. This comparison indicates that the equation of state developed in this project [16] may be satisfactorily extrapolated to 20°K for saturated vapor values. Since the vapor pressures are low, this indicates that the equation of state is satisfactory for the entire gaseous range from 80°K down to 20°K.

#### 3.2 Extension of Liquid Data to the Melting Line

New P-ρ-T data for the solid and liquid phase have been published in a doctoral dissertation by Willem van Wittenburg [19]. These data are for liquid from 93 to 153°K, with pressures from 70 to 2000 kg/cm<sup>2</sup>, and values for the adjacent solid phase. The values for the solid are limited to the region not more than 20°K below the melting point. These data have been compared to an extrapolation of the argon equation of state developed by Gosman [16]. The results of this comparison are given in Table X. As a result of this study, it has been found that the equation of state may be satisfactorily extrapolated to the melting line for the range of temperatures covered in this comparison.

### 4.0 VISCOSITY AND THERMAL CONDUCTIVITY OF THE DILUTE PHASES OF ARGON, NITROGEN, AND OXYGEN

The task for the compilation of the transport properties of cryogenic fluids was undertaken early in 1965. A preliminary bibliography was obtained from the Cryogenic Data Center's Documentation Unit, and literature searches have been completed for the transport properties of argon, oxygen, and nitrogen. Copies of all documents have been procured, and the numerical data and pertinent facts related to the data have been extracted and compiled on data sheets for task notebooks on argon, oxygen and nitrogen. A literature search for helium is in progress, and these data are being compiled in a task notebook.

A general survey of the theories of transport phenomena under different experimental conditions was also undertaken. The initial phase of this study was concerned with the simplest case, that of a non-quantum gas with a spherically symmetrical force field. Argon was chosen for this initial study, and the Chapman-Enskog theory was applied to the viscosity, thermal conductivity, and the self-diffusion coefficients for argon. The best potential function was selected and the optimum potential parameter determined. This work is reported in a publication [20]. Transport property data for dilute argon have been calculated and will also be published [21]. A further result of this initial study was the development of a general method to determine the best intermolecular potential functions as a means of determining the optimum correlation of given sets of data for transport and thermodynamic data. This general method has been applied to the data for oxygen and nitrogen, and preliminary results for the viscosity coefficients have been calculated. This project is now continuing under other funding and compilations of the transport properties of the dilute cryogenic fluids will be continued. The study of transport phenomena for the dense fluid has now been undertaken, and the compilation of transport phenomena for the cryogenic fluids will be extended to the dense fluids.

The variation of the force constants of the Lennard-Jones, Exp: 6, and Kihara potential functions was investigated by comparing the Chapman-Enskog kinetic theory expression for the viscosity coefficient with experimental viscosity of dilute argon. It was found that this variation was more pronounced than expected. Of the three, the Kihara was found to give the best correlation, and tables of the viscosity and thermal conductivity coefficients of dilute argon between 90 and 2000°K were computed from this potential and the Chapman-Enskog equations. The variations of the experimental data for viscosity with the calculated values are illustrated in figure 9. This figure also includes comparisons of the oxygen and nitrogen data which are discussed below. Figure 10 illustrates comparisons of the thermal conductivity data for argon from the same theoretical equations using the corresponding thermal conductivity expression. Table XI includes viscosity and thermal conductivity for dilute argon. These data are for dilute argon which may be defined according to the range of pressures and temperatures under curve 1 in figure 11. This is a plot of the pressure versus temperature limiting dilution curves for argon. Curve 1 was constructed by comparing the experimental viscosity coefficients with the theoretical equation, and is the curve for a one percent deviation. Curve 2 which represents a two percent deviation between theory and experiment is included for a comparison.

Preliminary calculations for the viscosity of oxygen and nitrogen have been completed. The deviations of the data for these gases from the equations are illustrated in figure 9. Preliminary tables of viscosity are given in Tables XII and XIII.

TABLE IX - COMPARISON OF SPECIFIC VOLUMES OF SATURATED SOLID AND SATURATED VAPOR FOR ARGON

Temp. °K	Volume of Vapor (liter/mol)		Volume of Solid (liter/mol)		Heat of Sublimation (liter atm/mol)	
	(Ziegler)	(Gosman)	(Ziegler)	(Gosman)	(Ziegler)	(Gosman)
80	1.63364 x 10	1.63292 x 10	0.02388	0.02442	77.071	77.036
75	3.42233 x 10	3.42200 x 10	0.02388	0.02418	77.781	77.751
70	7.98656 x 10	7.98720 x 10	0.02388	0.02398	78.342	78.349
65	2.136599 x 10 <sup>2</sup>	2.136006 x 10 <sup>2</sup>	0.02388	0.02380	78.788	78.766
60	6.790032 x 10 <sup>2</sup>	6.789348 x 10 <sup>2</sup>	0.02388	0.02362	79.156	79.148
55	2.6944892 x 10 <sup>3</sup>	2.6938980 x 10 <sup>3</sup>	0.02388	0.02346	79.457	79.440
50	1.4304153 x 10 <sup>4</sup>	1.4302511 x 10 <sup>4</sup>	0.02291	0.02329	79.701	79.692
40	1.4850475 x 10 <sup>6</sup>	1.4847775 x 10 <sup>6</sup>	0.02291	0.02300	80.006	79.992
30	3.7799257 x 10 <sup>9</sup>	3.7794339 x 10 <sup>9</sup>	0.02291	0.02277	80.002	79.992
20	2.7474483 x 10 <sup>16</sup>	2.7471656 x 10 <sup>16</sup>	0.02239	0.02265	79.527	79.519

Column 2 .... Values calculated with Clapeyron equation using Ziegler's data [18].

Column 3 .... Calculated with Gosman's equation of state [16].

Column 4 .... Data used by Ziegler et al. [18].

Column 5 .... Gosman's approximations (from a graphical plot) [16].

Column 6 .... Data from Ziegler et al. [18].

Column 7 .... Calculated with Clapeyron equation using values from Gosman's equation of state [16].

TABLE X - COMPARISON OF EXPERIMENTAL LIQUID ARGON DENSITIES AT THE MELTING LINE  
TO DENSITIES CALCULATED WITH GOSMAN'S EQUATION OF STATE

T(°K) (van Wittenburg)	ρ(mol/liter)	T(°K) (this research)	ρ(mol/liter)
83.81	34.896	83.81	35.411
93.15	35.997	93.15	36.452
98.15	36.548	98.15	36.909
103.15	37.049	103.15	37.328
108.15	37.574	108.15	37.722
113.15	38.025	113.15	38.100
118.15	38.451	118.15	38.464

Columns 1 & 2 ... Experimental liquid densities from van Wittenburg [19].

Columns 3 & 4 ... Calculated with Gosman's equation of state [16].

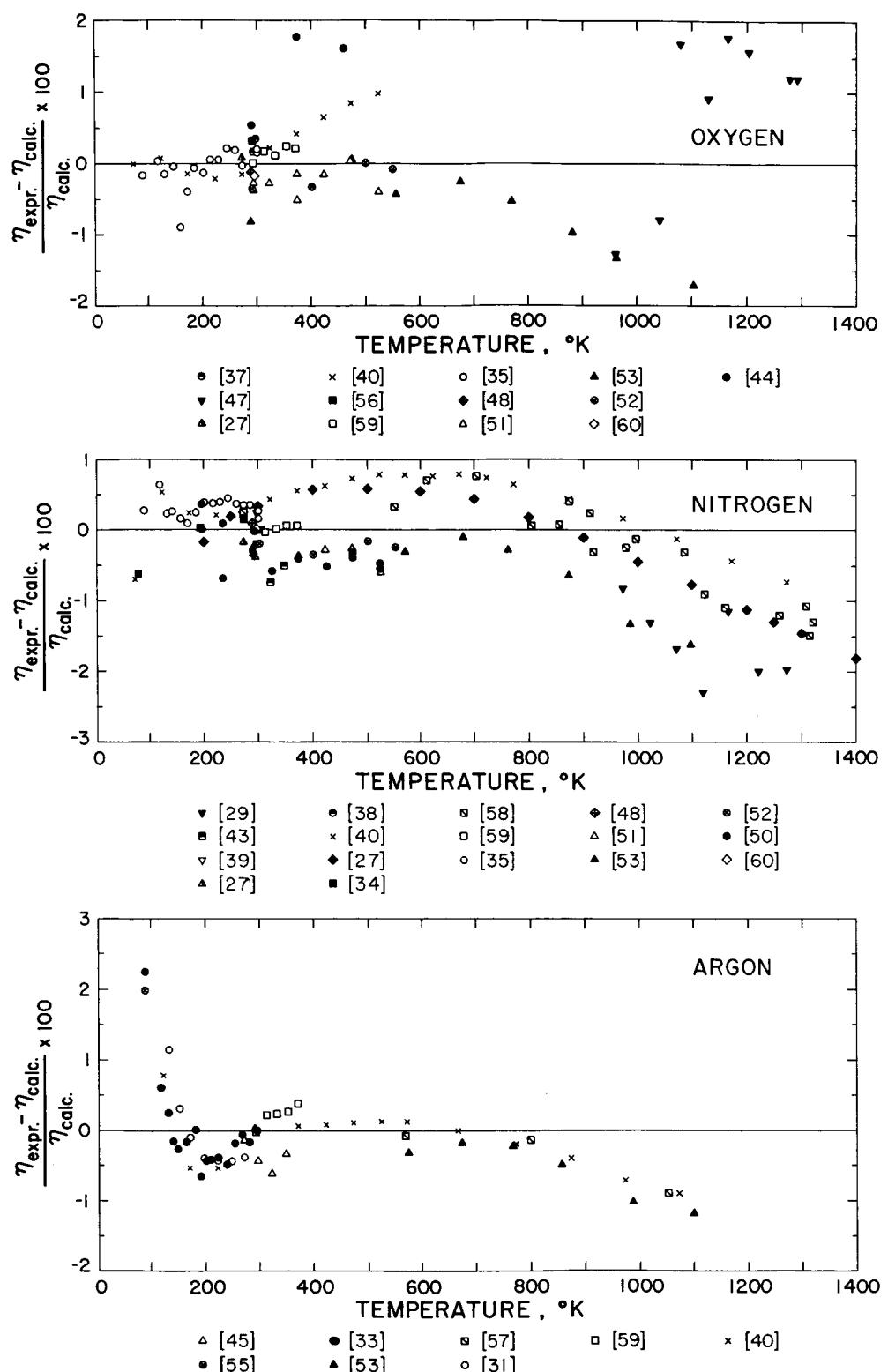


Fig. 9. Percent viscosity deviations of experimental data for oxygen, nitrogen, and argon from values calculated by the Kihara potential.

For oxygen,  $\gamma = .1$ ,  $\sigma = 3.38 \text{ \AA}$ ,  $\epsilon/k = 124.5^\circ\text{K}$ ;  
 for nitrogen,  $\gamma = .2$ ,  $\sigma = 3.55 \text{ \AA}$ ,  $\epsilon/k = 116.7^\circ\text{K}$ ;  
 for argon,  $\gamma = .1$ ,  $\sigma = 3.35 \text{ \AA}$ ,  $\epsilon/k = 139.8^\circ\text{K}$ .

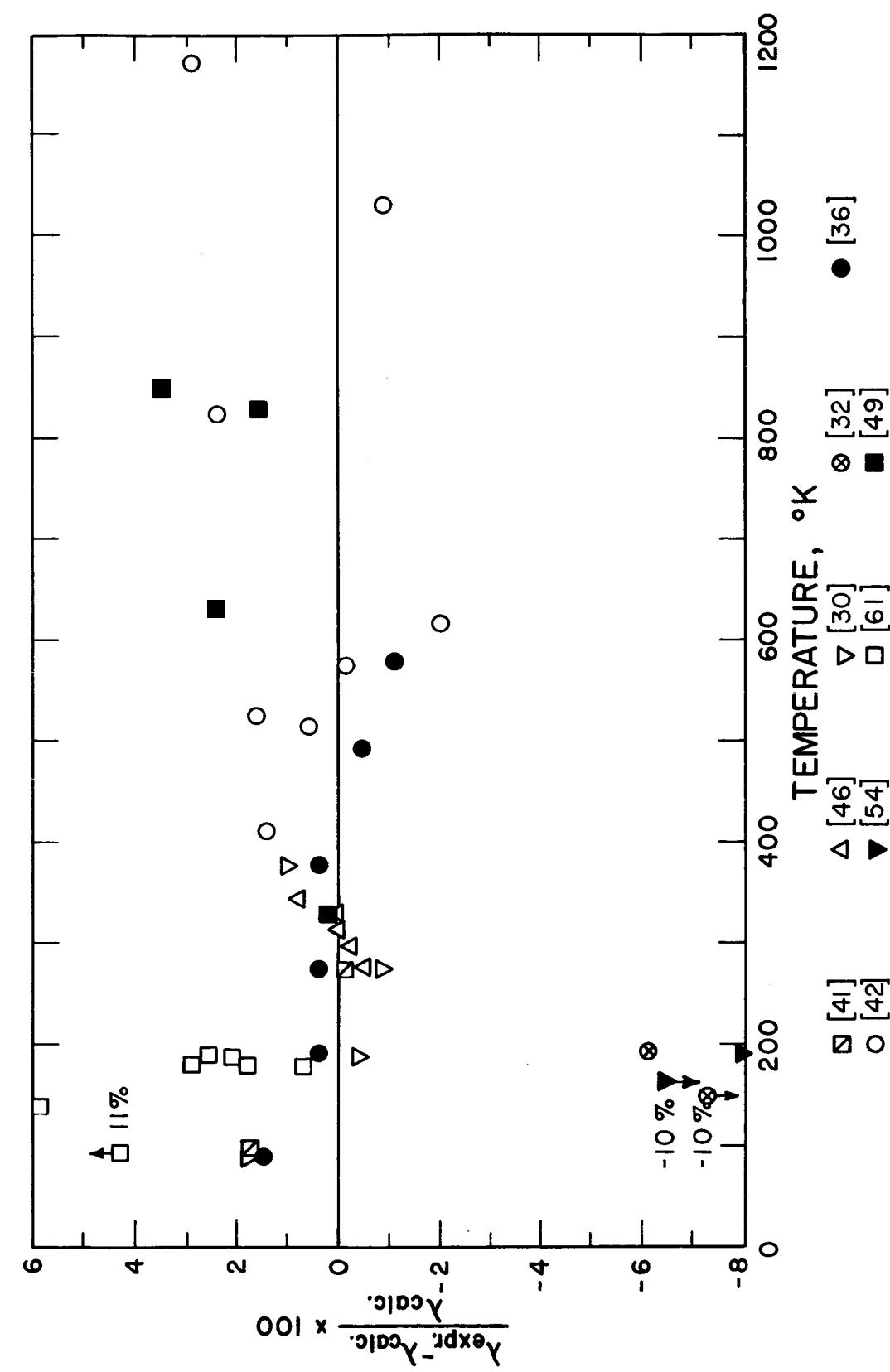


Fig. 10. Percent thermal conductivity deviations of experimental data for argon from values calculated by the Kihara potential with  $\gamma = .1$ ,  $\sigma = 3.35 \text{ \AA}$ ,  $\epsilon/k = 139.8 \text{ }^\circ\text{K}$ .

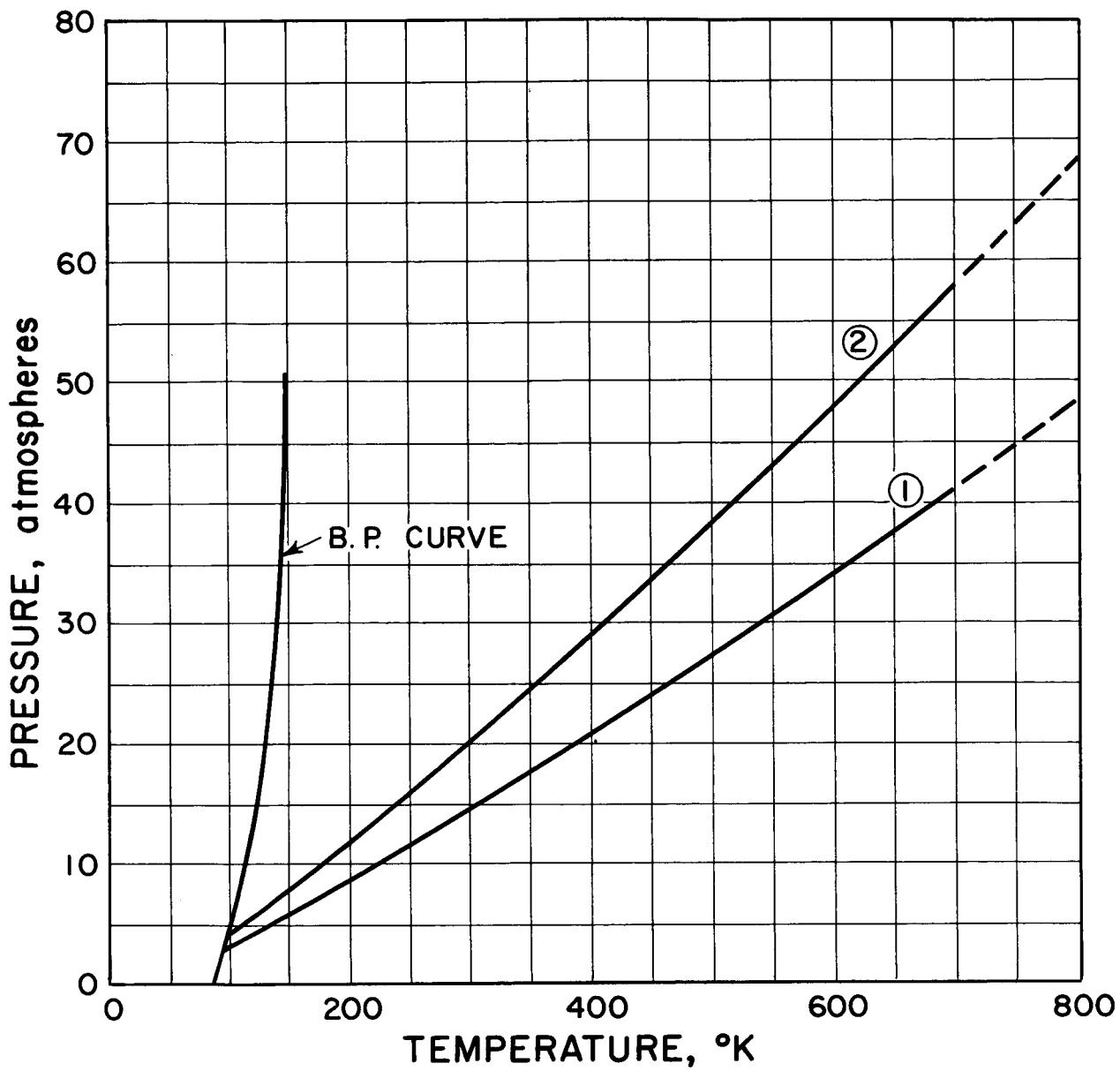


Fig. 11. Limiting range for dilute argon. Curve 1 was determined by comparing experimental viscosity coefficients with the theoretical equation, and is the curve for a 1% deviation. Curve 2 represents a 2% deviation between theory and experiment and is included for comparison.

TABLE XI VISCOSITY AND THERMAL CONDUCTIVITY OF GASEOUS ARGON\*

(Reprinted from NBS Technical Note No. 333 [ 21 ] )

TEMPERATURE K	VISCOSITY G/CM-SEC $\eta \times 10^6$	THERMAL CONDUCTIVITY CAL/CM-SEC-DEG $\lambda \times 10^6$	TEMPERATURE K	VISCOSITY G/CM-SEC $\eta \times 10^6$	THERMAL CONDUCTIVITY CAL/CM-SEC-DEG $\lambda \times 10^6$
500	334.9	62.5	500	334.9	62.5
510	339.8	63.4	510	339.8	63.4
520	344.5	64.3	520	344.5	64.3
530	349.2	65.1	530	349.2	65.1
540	353.8	66.0	540	353.8	66.0
550	358.3	66.8	550	358.3	66.8
560	362.9	67.7	560	362.9	67.7
570	367.4	68.5	570	367.4	68.5
580	371.9	69.4	580	371.9	69.4
590	376.4	70.2	590	376.4	70.2
100	82.5	15.4	600	380.8	71.0
110	90.6	16.9	610	385.1	71.8
120	98.7	18.4	620	389.5	72.6
130	106.8	19.9	630	393.8	73.4
140	114.8	21.4	640	398.0	74.2
150	122.7	22.9	650	402.3	75.0
160	130.4	24.3	660	406.5	75.8
170	138.1	25.8	670	410.6	76.6
180	145.7	27.2	680	414.8	77.4
190	153.1	28.6	690	418.9	78.1
200	160.4	29.9	700	423.0	78.9
210	167.7	31.3	710	427.1	79.7
220	174.6	32.6	720	431.1	80.4
230	181.6	33.9	730	435.1	81.2
240	188.5	35.2	740	439.1	81.9
250	195.2	36.4	750	443.1	82.6
260	201.8	37.6	760	447.1	83.4
270	208.3	38.9	770	451.0	84.1
280	214.7	40.0	780	454.7	84.8
290	220.9	41.2	790	458.4	85.5
300	227.1	42.4	800	462.5	86.3
310	233.3	43.5	810	466.3	87.0
320	239.4	44.6	820	470.0	87.7
330	245.2	45.7	830	473.8	88.4
340	251.0	46.8	840	477.6	89.1
350	256.7	47.9	850	481.3	89.8
360	262.4	48.9	860	485.0	90.5
370	268.1	50.0	870	488.7	91.2
380	273.6	51.0	880	492.4	91.9
390	279.1	52.1	890	496.1	92.5
400	284.5	53.1	900	499.8	93.2
410	289.8	54.1	910	503.5	93.9
420	295.1	55.0	920	507.1	94.6
430	300.4	56.0	930	510.7	95.3
440	305.5	57.0	940	514.4	95.9
450	310.5	57.9	950	518.0	96.6
460	315.5	58.9	960	521.5	97.3
470	320.5	59.8	970	525.1	97.9
480	325.4	60.7	980	528.7	98.6
490	330.3	61.6	990	532.2	99.3

\* Calculated for the dilute gas by the Kihara potential, with  $\gamma = .1$ ,  $\sigma = 3.35 \text{ \AA}$ ,  $e/k = 139.8^\circ\text{K}$ .  
 Figure 11 defines temperature and pressure range for the dilute gas.

TABLE XI VISCOSITY AND THERMAL CONDUCTIVITY OF GASEOUS ARGON (cont.)

TEMPERATURE K	VISCOSITY G/CM-SEC $\eta \times 10^6$	THERMAL CONDUCTIVITY CAL/CM-SEC-DEG $\lambda \times 10^6$	TEMPERATURE K	VISCOSITY G/CM-SEC $\eta \times 10^6$	THERMAL CONDUCTIVITY CAL/CM-SEC-DEG $\lambda \times 10^6$
1000	535.6	99.9	1500	695.4	129.7
1010	539.0	100.5	1510	698.4	130.3
1020	542.6	101.2	1520	701.3	130.8
1030	546.0	101.8	1530	704.3	131.4
1040	549.4	102.5	1540	707.2	131.9
1050	552.9	103.1	1550	710.1	132.4
1060	556.3	103.8	1560	713.0	133.0
1070	559.7	104.4	1570	715.9	133.5
1080	563.0	105.0	1580	718.9	134.1
1090	566.4	105.6	1590	721.7	134.6
1100	569.8	106.3	1600	724.6	135.2
1110	573.1	106.9	1610	727.5	135.7
1120	576.5	107.5	1620	730.4	136.2
1130	579.8	108.1	1630	733.3	136.8
1140	583.1	108.8	1640	736.1	137.3
1150	586.4	109.4	1650	739.0	137.8
1160	589.7	110.0	1660	741.8	138.4
1170	593.0	110.6	1670	744.7	138.9
1180	596.3	111.2	1680	747.4	139.4
1190	599.5	111.8	1690	750.2	139.9
1200	602.8	112.4	1700	753.0	140.4
1210	606.0	113.0	1710	755.8	141.0
1220	609.2	113.6	1720	758.6	141.5
1230	612.4	114.2	1730	761.6	142.1
1240	615.5	114.8	1740	764.4	142.6
1250	618.8	115.4	1750	767.2	143.1
1260	622.0	116.0	1760	770.0	143.6
1270	625.2	116.6	1770	772.7	144.1
1280	628.3	117.2	1780	775.5	144.6
1290	631.4	117.8	1790	778.3	145.2
1300	634.6	118.4	1800	781.0	145.7
1310	637.7	118.9	1810	783.8	146.2
1320	640.8	119.5	1820	786.5	146.7
1330	643.9	120.1	1830	789.3	147.2
1340	647.0	120.7	1840	792.0	147.7
1350	650.1	121.3	1850	794.7	148.2
1360	653.2	121.8	1860	797.4	148.7
1370	656.3	122.4	1870	800.1	149.2
1380	659.4	123.0	1880	802.8	149.7
1390	662.4	123.6	1890	805.5	150.2
1400	665.5	124.1	1900	808.2	150.7
1410	668.5	124.7	1910	810.8	151.2
1420	671.6	125.3	1920	813.5	151.7
1430	674.6	125.8	1930	816.2	152.2
1440	677.6	126.4	1940	818.8	152.7
1450	680.5	126.9	1950	821.5	153.2
1460	683.5	127.5	1960	824.1	153.7
1470	686.4	128.0	1970	827.0	154.3
1480	689.5	128.6	1980	829.7	154.7
1490	692.5	129.2	1990	832.3	155.2
			2000	834.9	155.7

TABLE XII VISCOSITY OF GASEOUS OXYGEN\*

(PRELIMINARY TABLE)

TEMP K	VISCOSITY G/CM-SEC $\eta \times 10^6$	TEMP K	VISCOSITY G/CM-SEC $\eta \times 10^6$
100	76.7	600	341.9
110	84.2	610	345.8
120	91.7	620	349.6
130	99.1	630	353.4
140	106.4	640	357.2
150	113.5	650	360.9
160	120.6	660	364.7
170	127.6	670	368.3
180	134.4	680	372.0
190	141.0	690	375.6
200	147.5	700	379.1
210	154.0	710	382.8
220	160.3	720	386.3
230	166.5	730	389.8
240	172.6	740	393.3
250	178.5	750	396.8
260	184.3	760	400.3
270	190.1	770	403.8
280	195.8	780	407.2
290	201.3	790	410.7
300	206.7	800	414.1
310	212.1	810	417.5
320	217.4	820	420.9
330	222.6	830	424.3
340	227.7	840	427.6
350	232.9	850	431.0
360	237.9	860	434.3
370	242.8	870	437.7
380	247.7	880	441.0
390	252.5	890	444.2
400	257.2	900	447.3
410	261.9	910	450.5
420	266.5	920	453.8
430	271.1	930	457.0
440	275.6	940	460.2
450	280.0	950	463.4
460	284.4	960	466.5
470	288.8	970	469.6
480	293.1	980	472.8
490	297.3	990	475.9

\* Calculated for the dilute gas by the Kihara potential, with  $\gamma = .1$ ,  $\sigma = 3.38 \text{ \AA}$ ,  $\epsilon/k = 124.5^\circ\text{K}$ .

TABLE XII VISCOSITY OF GASEOUS OXYGEN (cont.)

TEMP K	VISCOSITY G/CM-SEC $\eta \times 10^6$	TEMP K	VISCOSITY G/CM-SEC $\eta \times 10^6$
1000	479.0	1500	621.0
1010	482.1	1510	623.6
1020	485.2	1520	626.2
1030	488.3	1530	628.8
1040	491.3	1540	631.4
1050	494.4	1550	634.2
1060	497.4	1560	636.8
1070	500.5	1570	639.4
1080	503.5	1580	642.0
1090	506.4	1590	644.6
1100	509.4	1600	647.1
1110	512.4	1610	649.7
1120	515.4	1620	652.3
1130	518.3	1630	654.8
1140	521.2	1640	657.3
1150	524.2	1650	659.9
1160	527.1	1660	662.4
1170	530.0	1670	664.9
1180	532.9	1680	667.4
1190	535.8	1690	669.9
1200	538.7	1700	672.4
1210	541.5	1710	674.9
1220	544.4	1720	677.4
1230	547.3	1730	679.8
1240	550.1	1740	682.3
1250	553.0	1750	684.9
1260	555.8	1760	687.4
1270	558.6	1770	689.9
1280	561.4	1780	692.4
1290	564.2	1790	694.8
1300	566.9	1800	697.3
1310	569.7	1810	699.8
1320	572.5	1820	702.2
1330	575.3	1830	704.6
1340	578.0	1840	707.1
1350	580.8	1850	709.5
1360	583.5	1860	711.9
1370	586.3	1870	714.4
1380	589.0	1880	716.8
1390	591.7	1890	719.1
1400	594.4	1900	721.5
1410	597.1	1910	723.9
1420	599.8	1920	726.3
1430	602.5	1930	728.6
1440	605.2	1940	731.0
1450	607.9	1950	733.4
1460	610.5	1960	735.9
1470	613.2	1970	738.3
1480	615.8	1980	740.6
1490	618.4	1990	743.0
		2000	745.4

TABLE XIII VISCOSITY OF GASEOUS NITROGEN\*

(PRELIMINARY TABLE)

TEMP K	VISCOSITY G/CM-SEC $\eta \times 10^6$	TEMP K	VISCOSITY G/CM-SEC $\eta \times 10^6$
100	69.3	600	289.5
110	75.8	610	292.7
120	82.2	620	295.8
130	88.5	630	299.0
140	94.7	640	302.1
150	100.7	650	305.0
160	106.7	660	308.0
170	112.4	670	311.1
180	118.1	680	314.1
190	123.7	690	317.1
200	129.2	700	320.0
210	134.5	710	323.0
220	139.8	720	325.9
230	144.9	730	328.8
240	149.9	740	331.7
250	154.8	750	334.6
260	159.7	760	337.5
270	164.4	770	340.3
280	169.1	780	343.2
290	173.7	790	346.0
300	178.2	800	348.8
310	182.7	810	351.6
320	187.1	820	354.4
330	191.4	830	357.1
340	195.6	840	359.8
350	199.8	850	362.5
360	203.9	860	365.1
370	207.9	870	367.9
380	211.9	880	370.6
390	215.8	890	373.3
400	219.7	900	375.9
410	223.6	910	378.5
420	227.4	920	381.2
430	231.2	930	383.8
440	234.9	940	386.4
450	238.6	950	389.0
460	242.2	960	391.6
470	245.8	970	394.2
480	249.4	980	396.7
490	252.9	990	399.3

\* Calculated for the dilute gas by the Kihara potential, with  $\gamma = .2$ ,  $\sigma = 3.55 \text{ \AA}$ ,  $e/k = 116.7^\circ\text{K}$ .

TABLE XIII VISCOSITY OF GASEOUS NITROGEN (cont.)

TEMP K	VISCOSITY G/CM-SEC $\eta \times 10^6$	TEMP K	VISCOSITY G/CM-SEC $\eta \times 10^6$
1000	401.8	1500	517.5
1010	404.3	1510	519.6
1020	406.8	1520	521.7
1030	409.3	1530	523.8
1040	411.7	1540	526.0
1050	414.3	1550	528.1
1060	416.8	1560	530.2
1070	419.2	1570	532.3
1080	421.7	1580	534.3
1090	424.1	1590	536.4
1100	426.6	1600	538.5
1110	429.0	1610	540.5
1120	431.4	1620	542.6
1130	433.8	1630	544.7
1140	436.2	1640	546.7
1150	438.6	1650	548.9
1160	441.0	1660	551.0
1170	443.4	1670	553.0
1180	445.8	1680	555.1
1190	448.1	1690	557.1
1200	450.5	1700	559.1
1210	452.8	1710	561.2
1220	455.1	1720	563.2
1230	457.4	1730	565.2
1240	459.7	1740	567.2
1250	462.0	1750	569.2
1260	464.3	1760	571.2
1270	466.6	1770	573.2
1280	468.9	1780	575.2
1290	471.2	1790	577.2
1300	473.4	1800	579.2
1310	475.7	1810	581.1
1320	478.0	1820	583.1
1330	480.2	1830	585.1
1340	482.5	1840	587.0
1350	484.7	1850	589.1
1360	486.9	1860	591.1
1370	489.1	1870	593.0
1380	491.4	1880	595.0
1390	493.6	1890	597.0
1400	495.7	1900	598.9
1410	497.9	1910	600.8
1420	500.1	1920	602.8
1430	502.3	1930	604.7
1440	504.5	1940	606.6
1450	506.7	1950	608.6
1460	508.9	1960	610.5
1470	511.0	1970	612.4
1480	513.2	1980	614.3
1490	515.3	1990	616.2
		2000	618.1

#### 5.0 OTHER DATA COMPILATIONS

Literature searches have been completed for binary mixtures of the cryogenic fluids including mixtures of O<sub>2</sub> and N<sub>2</sub>, A and N<sub>2</sub>, O<sub>2</sub> and He, N<sub>2</sub> and He, H<sub>2</sub> and He, and F<sub>2</sub> and He. The published data have been extracted from the documents and compiled on work sheets for a task notebook. It is anticipated that this task will be continued under other funding and that critical evaluations and compilations will be made for these data.

A literature search has also been completed on the thermophysical properties of fluorine. All of the data have been extracted from the literature and compiled on work sheets for a task notebook. There is a paucity of information on the properties of fluorine, and any compilation of tables would necessitate considerable extrapolation from this data. It is anticipated that a compilation of the data on fluorine will be prepared in a manuscript and issued as an NBS Report.

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## 7.0 APPENDIX

### TABLES OF THERMODYNAMICS OF OXYGEN

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Saturation Properties . . . . .	30
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The number of significant figures given in the tables is not justified on the basis of the uncertainties of the data, but is presented to maintain internal consistency.

Particular notice is given to the liquid data at low temperatures. No P-V-T data are available for temperatures below 65°K, and values from 65° to the triple point (55.353°K) are an extrapolation of the equation (1). The estimated uncertainty of the critical point density is  $\pm 2\%$ .

Tables of the thermodynamic properties of oxygen with additional isobars will be available from the Cryogenic Data Center after July 1, 1966.

SATURATION PROPERTIES

TEMP. K	PRESSURE ATM	DENSITY MOL/LITER		ENTHALPY J/MOL		ENTROPY J/MOL-K	
		VAPOR	LIQUID	VAPOR	LIQUID	VAPOR	LIQUID
54.353	0.00150	0.0003364	41.2928	1571.8	-5948.4	209.43	71.07
55	0.00182	0.0004044	41.1353	1590.6	-5934.9	208.15	71.32
56	0.00245	0.0005330	40.9064	1619.6	-5911.5	206.22	71.74
57	0.00325	0.0006956	40.6928	1648.6	-5885.3	204.38	72.20
58	0.00428	0.0008994	40.4923	1677.6	-5856.3	202.60	72.71
59	0.00558	0.0011524	40.3028	1706.6	-5824.9	200.90	73.24
60	0.00720	0.0014640	40.1226	1735.5	-5791.3	199.26	73.81
61	0.00922	0.0018445	39.9503	1764.4	-5755.5	197.68	74.40
62	0.01172	0.0023057	39.7844	1793.3	-5717.7	196.16	75.02
63	0.01477	0.0028605	39.6239	1822.1	-5678.2	194.70	75.65
64	0.01847	0.0035231	39.4678	1850.8	-5637.0	193.29	76.30
65	0.02294	0.0043093	39.3153	1879.5	-5594.3	191.94	76.96
66	0.02830	0.0052361	39.1657	1908.1	-5550.2	190.64	77.63
67	0.03467	0.0063219	39.0184	1936.6	-5504.9	189.38	78.31
68	0.04221	0.0075866	38.8730	1965.0	-5458.4	188.17	79.00
69	0.05108	0.0090515	38.7289	1993.3	-5410.9	187.00	79.69
70	0.06145	0.0107391	38.5859	2021.6	-5362.4	185.88	80.39
71	0.07351	0.0126735	38.4435	2049.7	-5313.0	184.79	81.09
72	0.08747	0.0148800	38.3016	2077.6	-5262.9	183.74	81.79
73	0.10354	0.0173854	38.1599	2105.4	-5212.0	182.73	82.49
74	0.12196	0.0202176	38.0183	2133.1	-5160.6	181.76	83.19
75	0.14298	0.0234059	37.8766	2160.6	-5108.5	180.81	83.89
76	0.16685	0.0269806	37.7346	2187.9	-5055.9	179.90	84.59
77	0.19387	0.0309735	37.5922	2215.0	-5002.9	179.02	85.28
78	0.22431	0.0354171	37.4493	2242.0	-4949.4	178.16	85.97
79	0.25848	0.0403453	37.3059	2268.7	-4895.6	177.34	86.65
80	0.29671	0.0457931	37.1618	2295.1	-4841.4	176.54	87.33
81	0.33933	0.0517962	37.0171	2321.3	-4787.0	175.76	88.01
82	0.38667	0.0583917	36.8715	2347.3	-4732.2	175.01	88.68
83	0.43911	0.0656174	36.7252	2373.0	-4677.3	174.28	89.34
84	0.49701	0.0735120	36.5780	2398.4	-4622.1	173.58	90.00
85	0.56075	0.0821153	36.4299	2423.5	-4566.7	172.89	90.65
86	0.63073	0.0914681	36.2809	2448.3	-4511.2	172.22	91.30
87	0.70736	0.101611	36.1309	2472.7	-4455.5	171.58	91.94
88	0.79104	0.112588	35.9799	2496.9	-4399.7	170.95	92.58
89	0.88221	0.124442	35.8279	2520.6	-4343.7	170.33	93.21
90	0.98129	0.137217	35.6748	2544.0	-4287.7	169.74	93.83
90.18	1.00000	0.139618	35.6471	2548.2	-4277.6	169.63	93.94
91	1.08874	0.150959	35.5206	2567.0	-4231.5	169.16	94.45
92	1.20500	0.165713	35.3653	2589.6	-4175.3	168.59	95.06
93	1.33053	0.181528	35.2089	2611.8	-4118.9	168.04	95.66
94	1.46581	0.198451	35.0513	2633.6	-4062.5	167.50	96.26
95	1.61131	0.216533	34.8925	2654.9	-4006.1	166.97	96.86
96	1.76751	0.235823	34.7324	2675.8	-3949.5	166.46	97.44
97	1.93491	0.256375	34.5711	2696.2	-3892.9	165.95	98.02
98	2.11399	0.278241	34.4084	2716.2	-3836.2	165.46	98.60
99	2.30527	0.301476	34.2445	2735.6	-3779.4	164.98	99.17
100	2.50924	0.326138	34.0791	2754.6	-3722.6	164.51	99.74
101	2.72642	0.352284	33.9124	2773.0	-3665.7	164.04	100.30
102	2.95734	0.379975	33.7442	2790.8	-3608.7	163.59	100.85
103	3.20251	0.409271	33.5745	2808.1	-3551.7	163.15	101.40
104	3.46246	0.440239	33.4032	2824.9	-3494.5	162.71	101.94

## SATURATION PROPERTIES (CONT.)

TEMP. K	PRESSURE ATM	DENSITY MOL/LITER		ENTHALPY J/MOL		ENTROPY J/MOL-K	
		VAPOR	LIQUID	VAPOR	LIQUID	VAPOR	LIQUID
105	3.73773	0.472943	33.2304	2841.0	-3437.2	162.28	102.48
106	4.02886	0.507454	33.0560	2856.6	-3379.8	161.85	103.02
107	4.33639	0.543842	32.8798	2871.5	-3322.3	161.44	103.55
108	4.66087	0.582183	32.7020	2885.8	-3264.7	161.03	104.08
109	5.00285	0.622555	32.5223	2899.5	-3206.9	160.62	104.60
110	5.36289	0.665038	32.3407	2912.5	-3148.9	160.22	105.12
111	5.74154	0.709719	32.1572	2924.7	-3090.7	159.83	105.64
112	6.13937	0.756686	31.9717	2936.3	-3032.4	159.44	106.15
113	6.55696	0.806033	31.7841	2947.2	-2973.8	159.05	106.66
114	6.99487	0.857860	31.5944	2957.2	-2914.9	158.67	107.16
115	7.45368	0.912269	31.4024	2966.5	-2855.8	158.30	107.67
116	7.93398	0.969372	31.2080	2975.1	-2796.3	157.92	108.17
117	8.43634	1.02928	31.0112	2982.7	-2736.5	157.55	108.67
118	8.96137	1.09213	30.8118	2989.6	-2676.4	157.18	109.16
119	9.50965	1.15804	30.6098	2995.5	-2615.9	156.81	109.66
120	10.08177	1.22715	30.4050	3000.5	-2554.9	156.45	110.15
121	10.67835	1.29962	30.1972	3004.6	-2493.5	156.09	110.65
122	11.29999	1.37561	29.9863	3007.7	-2431.5	155.72	111.14
123	11.94729	1.45528	29.7723	3009.8	-2369.0	155.36	111.63
124	12.62088	1.53882	29.5548	3010.9	-2306.0	155.00	112.12
125	13.32137	1.62643	29.3337	3010.8	-2242.3	154.64	112.62
126	14.04939	1.71832	29.1088	3009.6	-2178.0	154.28	113.11
127	14.80556	1.81473	28.8799	3007.2	-2113.0	153.92	113.60
128	15.59053	1.91592	28.6467	3003.6	-2047.2	153.56	114.10
129	16.40494	2.02216	28.4090	2998.7	-1980.6	153.19	114.59
130	17.24943	2.13376	28.1665	2992.3	-1913.2	152.82	115.09
131	18.12467	2.25106	27.9188	2984.6	-1844.9	152.45	115.59
132	19.03133	2.37443	27.6656	2975.3	-1775.6	152.08	116.09
133	19.97008	2.50427	27.4065	2964.5	-1705.4	151.71	116.59
134	20.94164	2.64107	27.1410	2951.9	-1634.1	151.32	117.10
135	21.94670	2.78533	26.8686	2937.5	-1561.6	150.94	117.61
136	22.98601	2.93765	26.5887	2921.2	-1488.0	150.55	118.13
137	24.06031	3.09870	26.3007	2902.8	-1413.1	150.15	118.64
138	25.17041	3.26925	26.0037	2882.2	-1336.8	149.74	119.17
139	26.31710	3.45019	25.6970	2859.2	-1259.1	149.32	119.70
140	27.50126	3.64255	25.3795	2833.6	-1179.7	148.90	120.23
141	28.72378	3.84756	25.0499	2805.1	-1098.5	148.46	120.77
142	29.98563	4.06668	24.7068	2773.4	-1015.4	148.01	121.33
143	31.28783	4.30167	24.3485	2738.3	-930.1	147.54	121.89
144	32.63147	4.55467	23.9728	2699.2	-842.3	147.05	122.46
145	34.01775	4.82836	23.5771	2655.6	-751.5	146.54	123.05
146	35.44795	5.12614	23.1580	2606.8	-657.4	146.01	123.65
147	36.92348	5.45241	22.7113	2552.1	-559.2	145.44	124.28
148	38.44588	5.81304	22.2312	2490.3	-456.0	144.84	124.93
149	40.01686	6.21616	21.7097	2419.8	-346.5	144.18	125.62
150	41.63831	6.67349	21.1355	2338.4	-228.9	143.47	126.35
151	43.31233	7.20304	20.4912	2242.8	-100.4	142.67	127.15
152	45.04125	7.83572	19.7465	2127.9	44.5	141.76	128.05
153	46.82771	8.64085	18.8280	1982.7	219.6	140.66	129.14
154	48.67464	9.86252	17.4537	1760.0	467.4	139.08	130.69
154.77	50.14	13.3330	13.3330	1123.3	1123.3	134.87	134.87

## TABLES OF THERMODYNAMIC PROPERTIES OF OXYGEN

## 0.10 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
91		0.0134329	2632.8	1878.4	189.48				
92		0.0132857	2662.0	1899.3	189.80				
93		0.0131417	2691.2	1920.2	190.11				
94		0.0130008	2720.4	1941.0	190.42				
95		0.0128629	2749.6	1961.9	190.73				
96		0.0127280	2778.9	1982.8	191.04				
97		0.0125958	2808.1	2003.6	191.34				
98		0.0124664	2837.3	2024.5	191.64				
99		0.0123398	2866.5	2045.3	191.94				
100		0.0122154	2895.7	2066.2	192.23				
101		0.0120937	2924.9	2087.0	192.52				
102		0.0119744	2954.1	2107.9	192.81				
103		0.0118575	2983.3	2128.7	193.10				
104		0.0117428	3012.5	2149.6	193.38				
105		0.0116303	3041.7	2170.4	193.66				
106		0.0115200	3070.9	2191.3	193.93				
107		0.0114117	3100.1	2212.1	194.21				
108		0.0113055	3129.3	2233.0	194.48				
109		0.0112012	3158.4	2253.8	194.75				
110		0.0110989	3187.6	2274.7	195.01				
111		0.0109984	3216.8	2295.5	195.28				
112		0.0108997	3246.0	2316.3	195.54				
113		0.0108028	3275.2	2337.2	195.80				
114		0.0107076	3304.3	2358.0	196.06				
115		0.0106141	3333.5	2378.9	196.31				
116		0.0105222	3362.7	2399.7	196.56				
117		0.0104319	3391.9	2420.5	196.81				
118		0.0103431	3421.0	2441.4	197.06				
119		0.0102559	3450.2	2462.2	197.31				
120		0.0101700	3479.4	2483.0	197.55				
121		0.0100857	3508.5	2503.9	197.80				
122		0.0100027	3537.7	2524.7	198.04				
123		0.0099211	3566.9	2545.5	198.27				
124		0.0098408	3596.0	2566.4	198.51				
55	41.1356	-5934.7	-5935.0	71.32	125	0.0097618	3625.2	2587.2	198.74
56	40.9067	-5911.3	-5911.6	71.74	126	0.0096840	3654.4	2608.0	198.98
57	40.6931	-5889.1	-5889.3	72.20	127	0.0096075	3683.5	2628.8	199.21
58	40.4926	-5856.2	-5856.4	72.71	128	0.0095322	3712.7	2649.7	199.44
59	40.3031	-5824.8	-5825.0	73.24	129	0.0094581	3741.8	2670.5	199.66
60	40.1229	-5791.1	-5791.3	73.81	130	0.0093851	3771.0	2691.3	199.89
61	39.9505	-5755.3	-5755.5	74.40	131	0.0093132	3800.1	2712.1	200.11
62	39.7847	-5717.6	-5717.8	75.01	132	0.0092424	3829.3	2733.0	200.33
63	39.6241	-5678.0	-5678.3	75.65	133	0.0091727	3858.5	2753.8	200.55
64	39.4680	-5636.8	-5637.1	76.30	134	0.0091041	3887.6	2774.6	200.77
65	39.3155	-5594.2	-5594.4	76.96	135	0.0090365	3916.8	2795.4	200.99
66	39.1660	-5550.1	-5550.4	77.63	136	0.0089698	3945.9	2816.3	201.20
67	39.0187	-5504.8	-5505.0	78.31	137	0.0089042	3975.1	2837.1	201.42
68	38.8732	-5458.3	-5458.6	79.00	138	0.0088395	4004.2	2857.9	201.63
69	38.7291	-5410.8	-5411.0	79.69	139	0.0087757	4033.4	2878.7	201.84
70	38.5860	-5362.3	-5362.6	80.39	140	0.0087129	4062.5	2899.6	202.05
71	38.4436	-5313.0	-5313.2	81.09					
72	38.3016	-5262.9	-5263.1	81.79	141	0.0086509	4091.7	2920.4	202.26
72,791	38.1894	-5222.7	-5223.0	82.35	142	0.0085898	4120.8	2941.2	202.46
• 72,791	0.0168367	2099.7	1497.8	182.94	143	0.0085296	4150.0	2962.0	202.67
73	0.0167878	2105.8	1502.2	183.02	144	0.0084703	4179.1	2982.8	202.87
74	0.0165575	2135.1	1523.1	183.42	145	0.0084117	4208.3	3003.6	203.07
75	0.0163336	2164.4	1544.1	183.82	146	0.0083540	4237.4	3024.5	203.27
76	0.0161157	2193.8	1565.0	184.21	147	0.0082970	4266.5	3045.3	203.47
77	0.0159035	2223.1	1585.9	184.59	148	0.0082408	4295.7	3066.1	203.67
78	0.0156970	2252.4	1606.9	184.97	149	0.0081854	4324.8	3086.9	203.86
79	0.0154958	2281.7	1627.8	185.34	150	0.0081307	4354.0	3107.7	204.06
80	0.0152998	2311.0	1648.7	185.71					
81	0.0151087	2340.2	1669.6	186.07	151	0.0080767	4383.1	3128.6	204.25
82	0.0149223	2369.5	1690.5	186.43	152	0.0080235	4412.3	3149.4	204.44
83	0.0147406	2398.8	1711.4	186.79	153	0.0079709	4441.4	3170.2	204.64
84	0.0145633	2428.0	1732.3	187.14	154	0.0079191	4470.5	3191.0	204.83
85	0.0143902	2457.3	1753.2	187.48	155	0.0078679	4499.7	3211.8	205.01
86	0.0142212	2486.6	1774.0	187.82	156	0.0078174	4528.8	3232.6	205.20
87	0.0140562	2515.8	1794.9	188.16	157	0.0077675	4558.0	3253.5	205.39
88	0.01386949	2545.0	1815.8	188.50	158	0.0077182	4587.1	3274.3	205.57
89	0.0137374	2574.3	1836.7	188.83	159	0.0076696	4616.2	3295.1	205.76
90	0.0135834	2603.5	1857.6	189.15	160	0.0076216	4645.4	3315.9	205.94

\* PHASE CHANGE

## 0.10 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
161	0.0075741	4674.5	3336.7	206.12	231	0.0052768	6714.6	4794.4	216.64
162	0.0075273	4703.7	3357.5	206.30	232	0.0052540	6743.8	4815.3	216.77
163	0.0074810	4732.8	3378.3	206.48	233	0.0052315	6773.0	4836.1	216.89
164	0.0074354	4761.9	3399.2	206.66	234	0.0052091	6802.2	4857.0	217.02
165	0.0073902	4791.1	3420.0	206.84	235	0.0051869	6831.3	4877.8	217.14
166	0.0073456	4820.2	3440.8	207.01	236	0.0051649	6860.5	4898.7	217.27
167	0.0073016	4849.4	3461.6	207.19	237	0.0051431	6889.7	4919.6	217.39
168	0.0072580	4878.5	3482.4	207.36	238	0.0051215	6918.9	4940.4	217.51
169	0.0072150	4907.6	3503.2	207.53	239	0.0051001	6948.1	4961.3	217.64
170	0.0071725	4936.8	3524.0	207.71	240	0.0050788	6977.3	4982.2	217.76
171	0.0071305	4965.9	3544.9	207.88	241	0.0050577	7006.4	5003.0	217.88
172	0.0070890	4995.0	3565.7	208.05	242	0.0050368	7035.6	5023.9	218.00
173	0.0070480	5024.2	3586.5	208.22	243	0.0050161	7064.8	5044.8	218.12
174	0.0070074	5053.3	3607.3	208.38	244	0.0049955	7094.0	5065.6	218.24
175	0.0069673	5082.4	3628.1	208.55	245	0.0049751	7123.2	5086.5	218.36
176	0.0069276	5111.6	3648.9	208.72	246	0.0049549	7152.4	5107.4	218.48
177	0.0068885	5140.7	3669.7	208.88	247	0.0049348	7181.6	5128.3	218.60
178	0.0068497	5169.9	3690.5	209.05	248	0.0049149	7210.8	5149.2	218.72
179	0.0068114	5199.0	3711.4	209.21	249	0.0048951	7240.0	5170.1	218.83
180	0.0067735	5228.1	3732.2	209.37	250	0.0048755	7269.2	5191.0	218.95
181	0.0067360	5257.3	3753.0	209.53	251	0.0048561	7298.4	5211.8	219.07
182	0.0066990	5286.4	3773.8	209.69	252	0.0048368	7327.7	5232.7	219.18
183	0.0066623	5315.5	3794.6	209.85	253	0.0048177	7356.9	5253.6	219.30
184	0.0066261	5344.7	3815.4	210.01	254	0.0047987	7386.1	5274.5	219.41
185	0.0065902	5373.8	3836.3	210.17	255	0.0047799	7415.3	5295.4	219.53
186	0.0065547	5402.9	3857.1	210.33	256	0.0047612	7444.5	5316.3	219.64
187	0.0065196	5432.1	3877.9	210.48	257	0.0047427	7473.8	5337.3	219.76
188	0.0064849	5461.2	3898.7	210.64	258	0.0047243	7503.0	5358.2	219.87
189	0.0064506	5490.4	3919.5	210.79	259	0.0047060	7532.2	5379.1	219.98
190	0.0064166	5519.5	3940.3	210.95	260	0.0046879	7561.5	5400.0	220.10
191	0.0063829	5548.6	3961.2	211.10	261	0.0046700	7590.7	5420.9	220.21
192	0.0063497	5577.8	3982.0	211.25	262	0.0046521	7619.9	5441.8	220.32
193	0.0063167	5606.9	4002.8	211.40	263	0.0046344	7649.2	5462.8	220.43
194	0.0062841	5636.0	4023.6	211.55	264	0.0046169	7678.4	5483.7	220.54
195	0.0062519	5665.2	4044.4	211.70	265	0.0045994	7707.7	5504.6	220.65
196	0.0062199	5694.3	4065.2	211.85	266	0.0045821	7736.9	5525.5	220.76
197	0.0061883	5723.5	4086.1	212.00	267	0.0045650	7766.2	5546.5	220.87
198	0.0061571	5752.6	4106.9	212.15	268	0.0045479	7795.4	5567.4	220.98
199	0.0061261	5781.7	4127.7	212.30	269	0.0045310	7824.7	5588.4	221.09
200	0.0060954	5810.9	4148.5	212.44	270	0.0045142	7854.0	5609.3	221.20
201	0.0060651	5840.0	4169.3	212.59	271	0.0044976	7883.2	5630.3	221.31
202	0.0060350	5869.2	4190.2	212.73	272	0.0044810	7912.5	5651.2	221.42
203	0.0060053	5898.3	4211.0	212.88	273	0.0044646	7941.8	5672.2	221.52
204	0.0059758	5927.4	4231.8	213.02	274	0.0044483	7971.0	5693.1	221.63
205	0.0059466	5956.6	4252.6	213.16	275	0.0044321	8000.3	5714.1	221.74
206	0.0059177	5985.7	4273.5	213.30	276	0.0044161	8029.6	5735.1	221.84
207	0.0058891	6014.9	4294.3	213.44	277	0.0044001	8058.9	5756.0	221.95
208	0.0058608	6044.0	4315.1	213.58	278	0.0043843	8088.2	5777.0	222.05
209	0.0058327	6073.2	4335.9	213.72	279	0.0043685	8117.5	5798.0	222.16
210	0.0058049	6102.3	4356.8	213.86	280	0.0043529	8146.8	5819.0	222.26
211	0.0057774	6131.5	4377.6	214.00	281	0.0043374	8176.1	5840.0	222.37
212	0.0057501	6160.6	4398.4	214.14	282	0.0043221	8205.4	5861.0	222.47
213	0.0057231	6189.8	4419.3	214.28	283	0.0043068	8234.7	5882.0	222.58
214	0.0056963	6218.9	4440.1	214.41	284	0.0042916	8264.0	5903.0	222.68
215	0.0056698	6248.1	4460.9	214.55	285	0.0042765	8293.3	5924.0	222.78
216	0.0056435	6277.2	4481.8	214.68	286	0.0042616	8322.7	5945.0	222.89
217	0.0056175	6306.4	4502.6	214.82	287	0.0042467	8352.0	5966.0	222.99
218	0.0055917	6335.5	4523.4	214.95	288	0.0042320	8381.3	5987.0	223.09
219	0.0055662	6364.7	4544.3	215.09	289	0.0042173	8410.7	6008.0	223.19
220	0.0055408	6393.8	4565.1	215.22	290	0.0042028	8440.0	6029.0	223.29
221	0.0055157	6423.0	4585.9	215.35	291	0.0041883	8469.4	6050.1	223.39
222	0.0054909	6452.2	4606.8	215.48	292	0.0041740	8498.7	6071.1	223.50
223	0.0054662	6481.3	4627.6	215.61	293	0.0041597	8528.1	6092.1	223.60
224	0.0054418	6510.5	4648.5	215.74	294	0.0041456	8557.4	6113.2	223.70
225	0.0054176	6539.6	4669.3	215.87	295	0.0041315	8586.8	6134.2	223.80
226	0.0053936	6568.8	4690.2	216.00	296	0.0041176	8616.1	6155.3	223.89
227	0.0053699	6598.0	4711.0	216.13	297	0.0041037	8645.5	6176.3	223.99
228	0.0053463	6627.1	4731.8	216.26	298	0.0040899	8674.9	6197.4	224.09
229	0.0053229	6656.3	4752.7	216.39	299	0.0040762	8704.3	6218.5	224.19
230	0.0052998	6685.5	4773.5	216.52	300	0.0040626	8733.7	6239.5	224.29

## 0.40 ATMOSPHERE ISOMAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTHOPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
91		0.0542305	2613.5		1866.1		177.81		
92		0.0536209	2643.1		1887.2		178.14		
93		0.0530253	2672.7		1908.3		178.46		
94		0.0524431	2702.2		1929.4		178.77		
95		0.0518738	2731.8		1950.5		179.09		
96		0.0513172	2761.3		1971.5		179.40		
97		0.0507726	2790.9		1992.6		179.70		
98		0.0502398	2820.4		2013.6		180.01		
99		0.0497182	2849.9		2034.7		180.30		
100		0.0492077	2879.4		2055.7		180.60		
101		0.0487078	2908.9		2076.8		180.89		
102		0.0482181	2938.4		2097.8		181.19		
103		0.0477384	2967.8		2118.8		181.47		
104		0.0472683	2997.3		2139.8		181.76		
105		0.0468076	3026.7		2160.8		182.04		
106		0.0463559	3056.2		2181.8		182.32		
107		0.0459131	3085.6		2202.8		182.59		
108		0.0454788	3115.0		2223.8		182.87		
109		0.0450528	3144.4		2244.8		183.14		
110		0.0446348	3173.8		2265.8		183.41		
111		0.0442246	3203.2		2286.8		183.67		
112		0.0438220	3232.6		2307.7		183.94		
113		0.0434268	3262.0		2328.7		184.20		
114		0.0430388	3291.4		2349.7		184.46		
115		0.0426578	3320.8		2370.6		184.71		
116		0.0422836	3350.1		2391.6		184.97		
117		0.0419159	3379.5		2412.5		185.22		
118		0.0415547	3408.9		2433.5		185.47		
119		0.0411998	3438.2		2454.4		185.72		
120		0.0408509	3467.5		2475.4		185.96		
121		0.0405080	3496.9		2496.3		186.21		
122		0.0401709	3526.2		2517.2		186.45		
123		0.0398394	3555.5		2538.2		186.69		
124		0.0395134	3584.9		2559.1		186.93		
125		0.0391927	3614.2		2580.0		187.16		
126		0.0388773	3643.5		2601.0		187.39		
127		0.0385670	3672.8		2621.9		187.63		
128		0.0382616	3702.1		2642.8		187.86		
129		0.0379611	3731.4		2663.7		188.08		
130		0.0376654	3760.7		2684.6		188.31		
61	39.9516	-5754.7	-5755.7	74.40	131	0.0373742	3790.0	2705.5	188.53
62	39.7858	-5717.0	-5718.0	75.01	132	0.0370876	3819.3	2726.4	188.76
63	39.6253	-5677.4	-5678.5	75.64	133	0.0368054	3848.6	2747.4	188.98
64	39.4692	-5636.3	-5637.3	76.29	134	0.0365275	3877.9	2768.3	189.20
65	39.3167	-5593.6	-5594.6	76.95	135	0.0362537	3907.1	2789.2	189.42
66	39.1672	-5549.5	-5550.5	77.63	136	0.0359841	3936.4	2810.1	189.63
67	39.0199	-5504.2	-5505.2	78.31	137	0.0357186	3965.7	2831.0	189.85
68	38.8745	-5457.7	-5458.8	79.00	138	0.0354569	3995.0	2851.9	190.06
69	38.7304	-5410.2	-5411.2	79.69	139	0.0351991	4024.2	2872.7	190.27
70	38.5873	-5361.7	-5362.8	80.39	140	0.0349451	4053.5	2893.6	190.48
71	38.4449	-5312.4	-5313.4	81.09	141	0.0346947	4082.8	2914.5	190.69
72	38.3030	-5262.3	-5263.3	81.79	142	0.0344479	4112.0	2935.4	190.89
73	38.1613	-5211.5	-5212.5	82.49	143	0.0342046	4141.3	2956.3	191.10
74	38.0196	-5160.0	-5161.1	83.19	144	0.0339648	4170.5	2977.2	191.30
75	37.8778	-5108.0	-5109.1	83.89	145	0.0337283	4199.8	2998.1	191.51
76	37.7357	-5055.5	-5056.6	84.58	146	0.0334951	4229.0	3018.9	191.71
77	37.5932	-5002.5	-5003.6	85.28	147	0.0332652	4258.3	3039.8	191.91
78	37.4502	-4949.1	-4950.2	85.97	148	0.0330384	4287.5	3060.7	192.11
79	37.3066	-4895.3	-4896.4	86.65	149	0.0328147	4316.7	3081.6	192.30
80	37.1624	-4841.2	-4842.3	87.33	150	0.0325941	4346.0	3102.5	192.50
81	37.0174	-4786.9	-4787.9	88.01					
82	36.8716	-4732.2	-4733.3	88.68	151	0.0323764	4375.2	3123.3	192.69
• 82.264	36.8330	-4717.8	-4718.9	88.85	152	0.0321616	4404.4	3144.2	192.88
• 82.264	0.0602355	2354.1	1681.2	174.82	153	0.0319497	4433.7	3165.1	193.08
83	0.0596767	2376.0	1696.9	175.08	154	0.0317405	4462.9	3185.9	193.27
84	0.0589346	2405.8	1718.1	175.44	155	0.0315342	4492.1	3206.8	193.46
85	0.0582114	2435.5	1739.2	175.79	156	0.0313304	4521.3	3227.7	193.64
86	0.0575064	2465.2	1760.4	176.14	157	0.0311294	4550.6	3248.5	193.83
87	0.0568189	2494.9	1781.6	176.48	158	0.0309309	4579.8	3269.4	194.02
88	0.0561481	2524.6	1802.7	176.82	159	0.0307349	4609.0	3290.3	194.20
89	0.0554936	2554.2	1823.9	177.16	160	0.0305414	4638.2	3311.1	194.38
90	0.0548545	2583.9	1845.0	177.49					

• PHASE CHANGE

## 0.40 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
161	0.0303504	4667.4	3332.0	194.57	231	0.0211190	6710.9	4791.7	205.10
162	0.0301617	4696.7	3352.9	194.75	232	0.0210277	6740.1	4812.5	205.23
163	0.0299754	4725.9	3373.7	194.93	233	0.0209372	6769.3	4833.4	205.36
164	0.0297914	4755.1	3394.6	195.11	234	0.0208475	6798.5	4854.3	205.48
165	0.0296096	4784.3	3415.4	195.28	235	0.0207586	6827.7	4875.2	205.61
166	0.0294301	4813.5	3436.3	195.46	236	0.0206704	6856.9	4896.0	205.73
167	0.0292527	4842.7	3457.2	195.63	237	0.0205830	6886.1	4916.9	205.85
168	0.0290775	4871.9	3478.0	195.81	238	0.0204963	6915.3	4937.8	205.98
169	0.0289044	4901.1	3498.9	195.98	239	0.0204103	6944.5	4958.7	206.10
170	0.0287333	4930.3	3519.7	196.15	240	0.0203251	6973.7	4979.6	206.22
171	0.0285643	4959.5	3540.6	196.33	241	0.0202405	7002.9	5000.5	206.34
172	0.0283972	4988.7	3561.4	196.50	242	0.0201567	7032.1	5021.3	206.46
173	0.0282321	5017.9	3582.3	196.67	243	0.0200736	7061.4	5042.2	206.58
174	0.0280689	5047.1	3603.1	196.83	244	0.0199911	7090.6	5063.1	206.70
175	0.0279076	5076.3	3624.0	197.00	245	0.0199093	7119.8	5084.0	206.82
176	0.0277482	5105.5	3644.8	197.17	246	0.0198282	7149.0	5104.9	206.94
177	0.0275905	5134.7	3665.7	197.33	247	0.0197478	7178.2	5125.8	207.06
178	0.0274347	5163.9	3686.5	197.50	248	0.0196680	7207.5	5146.7	207.18
179	0.0272806	5193.1	3707.4	197.66	249	0.0195888	7236.7	5167.6	207.30
180	0.0271283	5222.3	3728.2	197.82	250	0.0195103	7265.9	5188.5	207.41
181	0.0269776	5251.5	3749.1	197.99	251	0.0194324	7295.2	5209.4	207.53
182	0.0268286	5280.7	3769.9	198.15	252	0.0193551	7324.4	5230.3	207.65
183	0.0266813	5309.9	3790.8	198.31	253	0.0192784	7353.6	5251.2	207.76
184	0.0265356	5339.0	3811.6	198.46	254	0.0192024	7382.9	5272.1	207.88
185	0.0263914	5368.2	3832.5	198.62	255	0.0191269	7412.1	5293.1	207.99
186	0.0262489	5397.4	3853.3	198.78	256	0.0190521	7441.4	5314.0	208.11
187	0.0261078	5426.6	3874.2	198.94	257	0.0189778	7470.6	5334.9	208.22
188	0.0259683	5455.8	3895.0	199.09	258	0.0189041	7499.9	5355.8	208.33
189	0.0258303	5485.0	3915.9	199.25	259	0.0188310	7529.1	5376.7	208.45
190	0.0256937	5514.2	3936.7	199.40	260	0.0187584	7558.4	5397.7	208.56
191	0.0255586	5543.4	3957.5	199.55	261	0.0186864	7587.6	5418.6	208.67
192	0.0254249	5572.5	3978.4	199.71	262	0.0186149	7616.9	5439.5	208.78
193	0.0252926	5601.7	3999.2	199.86	263	0.0185440	7646.1	5460.5	208.90
194	0.0251617	5630.9	4020.1	200.01	264	0.0184737	7675.4	5481.4	209.01
195	0.0250321	5660.1	4040.9	200.16	265	0.0184038	7704.7	5502.4	209.12
196	0.0249038	5689.3	4061.8	200.31	266	0.0183345	7734.0	5523.3	209.23
197	0.0247769	5718.5	4082.6	200.46	267	0.0182657	7763.2	5544.3	209.34
198	0.0246513	5747.6	4103.5	200.61	268	0.0181974	7792.5	5565.2	209.45
199	0.0245269	5776.8	4124.3	200.75	269	0.0181297	7821.8	5586.2	209.56
200	0.0244038	5806.0	4145.2	200.90	270	0.0180624	7851.1	5607.1	209.67
201	0.0242819	5835.2	4166.0	201.04	271	0.0179956	7880.4	5628.1	209.77
202	0.0241612	5864.4	4186.9	201.19	272	0.0179294	7909.6	5649.0	209.88
203	0.0240418	5893.6	4207.7	201.33	273	0.0178636	7938.9	5670.0	209.99
204	0.0239235	5922.7	4228.5	201.48	274	0.0177983	7968.2	5691.0	210.10
205	0.0238063	5951.9	4249.4	201.62	275	0.0177335	7997.5	5712.0	210.20
206	0.0236904	5981.1	4270.2	201.76	276	0.0176691	8026.8	5732.9	210.31
207	0.0235755	6010.3	4291.1	201.90	277	0.0176052	8056.1	5753.9	210.42
208	0.0234618	6039.5	4311.9	202.04	278	0.0175418	8085.5	5774.9	210.52
209	0.0233491	6068.7	4332.8	202.18	279	0.0174788	8114.8	5795.9	210.63
210	0.0232375	6097.8	4353.6	202.32	280	0.0174163	8144.1	5816.9	210.73
211	0.0231270	6127.0	4374.5	202.46	281	0.0173542	8173.4	5837.9	210.84
212	0.0230176	6156.2	4395.3	202.60	282	0.0172926	8202.7	5858.9	210.94
213	0.0229092	6185.4	4416.2	202.74	283	0.0172314	8232.1	5879.9	211.04
214	0.0228018	6214.6	4437.0	202.87	284	0.0171706	8261.4	5900.9	211.15
215	0.0226954	6243.8	4457.9	203.01	285	0.0171103	8290.7	5921.9	211.25
216	0.0225900	6273.0	4478.8	203.14	286	0.0170504	8320.1	5942.9	211.35
217	0.0224855	6302.1	4499.6	203.28	287	0.0169909	8349.4	5963.9	211.46
218	0.0223821	6331.3	4520.5	203.41	288	0.0169318	8378.8	5985.0	211.56
219	0.0222795	6360.5	4541.3	203.55	289	0.0168731	8408.1	6006.0	211.66
220	0.0221780	6389.7	4562.2	203.68	290	0.0168149	8437.5	6027.0	211.76
221	0.0220773	6418.9	4583.0	203.81	291	0.0167570	8466.8	6048.1	211.86
222	0.0219776	6448.1	4603.9	203.94	292	0.0166995	8496.2	6069.1	211.96
223	0.0218787	6477.3	4624.8	204.08	293	0.0166425	8525.6	6090.2	212.06
224	0.0217808	6506.5	4645.6	204.21	294	0.0165858	8554.9	6111.2	212.16
225	0.0216837	6535.7	4666.5	204.34	295	0.0165295	8584.3	6132.3	212.26
226	0.0215875	6564.9	4687.3	204.47	296	0.0164736	8613.7	6153.3	212.36
227	0.0214921	6594.1	4708.2	204.59	297	0.0164180	8643.1	6174.4	212.46
228	0.0213976	6623.3	4729.1	204.72	298	0.0163629	8672.5	6195.5	212.56
229	0.0213039	6652.5	4749.9	204.85	299	0.0163081	8701.9	6216.5	212.66
230	0.0212110	6681.7	4770.8	204.98	300	0.0162536	8731.3	6237.6	212.76

## 0.70 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTHOPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
91		0.0958149	2543.6		1853.4		173.02		
92		0.0947088	2623.7		1874.7		173.35		
93		0.0936292	2653.6		1896.1		173.67		
94		0.0925752	2683.6		1917.4		173.99		
95		0.0915458	2713.5		1938.7		174.31		
96		0.0905401	2743.4		1960.0		174.62		
97		0.0895573	2773.3		1981.3		174.93		
98		0.0885965	2803.1		2002.5		175.24		
99		0.0876570	2833.0		2023.8		175.54		
100		0.0867380	2862.8		2045.0		175.84		
101		0.0858389	2892.6		2066.2		176.14		
102		0.0849589	2922.3		2087.5		176.43		
103		0.0840975	2952.1		2108.7		176.72		
104		0.0832540	2981.8		2129.8		177.01		
105		0.0824278	3011.5		2151.0		177.29		
106		0.0816185	3041.2		2172.2		177.57		
107		0.0808254	3070.9		2193.3		177.85		
108		0.0800481	3100.6		2214.5		178.13		
109		0.0792861	3130.2		2235.6		178.40		
110		0.0785389	3159.9		2256.8		178.67		
111		0.0778061	3189.5		2277.9		178.94		
112		0.0770872	3219.1		2299.0		179.21		
113		0.0763819	3248.7		2320.1		179.47		
114		0.0756897	3278.3		2341.2		179.73		
115		0.0750103	3307.9		2362.3		179.99		
116		0.0743434	3337.4		2383.4		180.24		
117		0.0736885	3367.0		2404.4		180.50		
118		0.0730453	3396.5		2425.5		180.75		
119		0.0724135	3426.1		2446.6		181.00		
120		0.0717928	3455.6		2467.6		181.25		
121		0.0711830	3485.1		2488.7		181.49		
122		0.0705936	3514.6		2509.7		181.73		
123		0.0699945	3544.1		2530.8		181.97		
124		0.0694153	3573.6		2551.8		182.21		
55	41.1373	-5933.7	-5935.5	71.31	125	0.0688459	3603.1	2572.8	182.45
56	40.9085	-5910.3	-5912.0	71.73	126	0.0682859	3632.6	2593.8	182.68
57	40.6950	-5884.0	-5885.8	72.20	127	0.0677352	3662.0	2614.9	182.92
58	40.4945	-5855.1	-5856.8	72.70	128	0.0671934	3691.5	2635.9	183.15
59	40.3051	-5823.7	-5825.4	73.24	129	0.0666604	3720.9	2656.9	183.38
60	40.1250	-5790.0	-5791.7	73.80	130	0.0661360	3750.4	2677.9	183.61
61	39.9527	-5754.2	-5755.9	74.39	131	0.0656199	3779.8	2698.9	183.83
62	39.7869	-5716.4	-5718.2	75.01	132	0.0651119	3809.2	2719.9	184.05
63	39.6264	-5676.9	-5678.7	75.64	133	0.0646119	3838.6	2740.9	184.28
64	39.4704	-5635.7	-5637.5	76.29	134	0.0641197	3868.1	2761.9	184.50
65	39.3179	-5593.0	-5594.8	76.95	135	0.0636350	3897.5	2782.8	184.72
66	39.1684	-5548.9	-5550.7	77.62	136	0.0631577	3926.9	2803.8	184.93
67	39.0212	-5503.6	-5505.4	78.31	137	0.0626887	3956.3	2824.8	185.15
68	38.8757	-5457.1	-5459.0	78.99	138	0.0622247	3985.7	2845.8	185.36
69	38.7317	-5409.6	-5411.4	79.69	139	0.0617686	4015.0	2866.7	185.57
70	38.5886	-5361.1	-5363.0	80.39	140	0.0613192	4044.4	2887.7	185.78
71	38.4463	-5311.8	-5313.7	81.08	141	0.0608764	4073.8	2908.7	185.99
72	38.3044	-5261.7	-5263.5	81.79	142	0.0604401	4103.2	2929.6	186.20
73	38.1627	-5210.9	-5212.7	82.49	143	0.0600101	4132.5	2950.6	186.41
74	38.0211	-5159.4	-5161.3	83.19	144	0.0595863	4161.9	2971.5	186.61
75	37.8793	-5107.4	-5109.3	83.88	145	0.0591684	4191.2	2992.5	186.81
76	37.7372	-5054.9	-5056.8	84.58	146	0.0587565	4220.6	3013.4	187.02
77	37.5948	-5001.9	-5003.8	85.27	147	0.0583504	4249.9	3034.3	187.22
78	37.4518	-4948.5	-4950.4	85.96	148	0.0579499	4279.3	3055.3	187.42
79	37.3083	-4894.8	-4896.7	86.65	149	0.0575549	4308.6	3076.2	187.61
80	37.1640	-4840.7	-4842.6	87.33	150	0.0571654	4337.9	3097.2	187.81
81	37.0191	-4786.3	-4788.2	88.00					
82	36.8733	-4731.7	-4733.6	88.67	151	0.0567811	4367.3	3118.1	188.00
83	36.7267	-4676.8	-4678.7	89.34	152	0.0564021	4396.6	3139.0	188.20
84	36.5792	-4621.7	-4623.6	90.00	153	0.0560281	4425.9	3159.9	188.39
85	36.4307	-4566.5	-4568.4	90.65	154	0.0556592	4455.2	3180.9	188.58
86	36.2813	-4511.0	-4513.0	91.30	155	0.0552951	4484.5	3201.8	188.77
• 86.908	36.1447	-4460.6	-4462.6	91.88	156	0.0549358	4513.8	3222.7	188.96
• 86.908	0.100641	2470.5	1765.7	171.64	157	0.0545812	4543.2	3243.6	189.15
87	0.100527	2473.3	1767.7	171.67	158	0.0542312	4572.5	3264.5	189.33
88	0.0993036	2503.4	1789.2	172.01	159	0.0538857	4601.8	3285.5	189.52
89	0.0981112	2533.5	1810.6	172.35	160	0.0535446	4631.1	3306.4	189.70
90	0.096987	2563.6	1832.0	172.69					

• PHASE CHANGE

## 0.70 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
161	0.0532079	4660.3	3327.3	189.88	231	0.0369788	6707.1	4788.9	200.44
162	0.0528754	4689.6	3348.2	190.07	232	0.0368186	6736.3	4809.6	200.57
163	0.0525471	4718.9	3369.1	190.25	233	0.0366599	6765.5	4830.7	200.69
164	0.0522229	4748.2	3390.0	190.42	234	0.0365025	6794.7	4851.6	200.82
165	0.0519026	4777.5	3410.9	190.60	235	0.0363465	6824.0	4872.5	200.94
166	0.0515864	4806.8	3431.8	190.78	236	0.0361918	6853.2	4893.4	201.07
167	0.0512740	4836.0	3452.7	190.96	237	0.0360385	6882.4	4914.3	201.19
168	0.0509654	4865.3	3473.6	191.13	238	0.0358864	6911.7	4935.2	201.31
169	0.0506605	4894.6	3494.5	191.30	239	0.0357356	6940.9	4956.1	201.44
170	0.0503593	4923.9	3515.4	191.48	240	0.0355861	6970.2	4977.0	201.56
171	0.0500617	4953.1	3536.3	191.65	241	0.0354378	6999.4	4997.9	201.68
172	0.0497676	4982.4	3557.2	191.82	242	0.0352908	7028.6	5018.8	201.80
173	0.0494770	5011.7	3578.1	191.99	243	0.0351450	7057.9	5039.7	201.92
174	0.0491898	5040.9	3599.0	192.16	244	0.0350004	7087.1	5060.6	202.04
175	0.0489059	5070.2	3619.8	192.32	245	0.0348569	7116.4	5081.5	202.16
176	0.0486253	5099.4	3640.7	192.49	246	0.0347147	7145.6	5102.4	202.28
177	0.0483479	5128.7	3661.6	192.66	247	0.0345736	7174.9	5123.3	202.40
178	0.0480737	5157.9	3682.5	192.82	248	0.0344337	7204.1	5144.2	202.52
179	0.0478026	5187.2	3703.4	192.99	249	0.0342949	7233.4	5165.1	202.63
180	0.0475346	5216.4	3724.3	193.15	250	0.0341572	7262.6	5186.1	202.75
181	0.0472696	5245.7	3745.2	193.31	251	0.0340206	7291.9	5207.0	202.87
182	0.0470076	5274.9	3766.0	193.47	252	0.0338851	7321.1	5227.9	202.98
183	0.0467485	5304.2	3786.9	193.63	253	0.0337507	7350.4	5248.8	203.10
184	0.0464922	5333.4	3807.8	193.79	254	0.0336173	7379.7	5269.8	203.22
185	0.0462387	5362.7	3828.7	193.95	255	0.0334850	7408.9	5290.7	203.33
186	0.0459881	5391.9	3849.6	194.11	256	0.0333538	7438.2	5311.6	203.45
187	0.0457401	5421.1	3870.4	194.26	257	0.0332235	7467.5	5332.5	203.56
188	0.0454948	5450.4	3891.3	194.42	258	0.0330943	7496.7	5353.5	203.67
189	0.0452522	5479.6	3912.2	194.58	259	0.0329661	7526.0	5374.4	203.79
190	0.0450121	5508.8	3933.1	194.73	260	0.0328389	7555.3	5395.4	203.90
191	0.0447746	5538.1	3953.9	194.88	261	0.0327127	7584.6	5416.3	204.01
192	0.0445396	5567.3	3974.8	195.04	262	0.0325874	7613.8	5437.2	204.12
193	0.0443071	5596.5	3995.7	195.19	263	0.0324631	7643.1	5458.2	204.23
194	0.0440770	5625.8	4016.6	195.34	264	0.0323397	7672.4	5479.1	204.35
195	0.0438493	5655.0	4037.4	195.49	265	0.0322173	7701.7	5500.1	204.46
196	0.0436239	5684.2	4058.3	195.64	266	0.0320958	7731.0	5521.1	204.57
197	0.0434009	5713.5	4079.2	195.79	267	0.0319752	7760.3	5542.0	204.68
198	0.0431801	5742.7	4100.0	195.94	268	0.0318555	7789.6	5563.0	204.79
199	0.0429616	5771.9	4120.9	196.08	269	0.0317368	7818.9	5583.9	204.90
200	0.0427454	5801.1	4141.8	196.23	270	0.0316189	7848.2	5604.9	205.00
201	0.0425312	5830.4	4162.7	196.37	271	0.0315018	7877.5	5625.9	205.11
202	0.0423193	5859.6	4183.5	196.52	272	0.0313857	7906.8	5646.9	205.22
203	0.0421094	5888.8	4204.4	196.66	273	0.0312704	7936.1	5667.8	205.33
204	0.0419017	5918.0	4225.3	196.81	274	0.0311559	7965.4	5688.8	205.44
205	0.0416960	5947.3	4246.1	196.95	275	0.0310423	7994.7	5709.8	205.54
206	0.0414923	5976.5	4267.0	197.09	276	0.0309295	8024.1	5730.8	205.65
207	0.0412906	6005.7	4287.9	197.23	277	0.0308175	8053.4	5751.8	205.75
208	0.0410908	6034.9	4308.8	197.38	278	0.0307064	8082.7	5772.8	205.86
209	0.0408930	6064.1	4329.6	197.52	279	0.0305960	8112.0	5793.8	205.97
210	0.0406971	6093.4	4350.5	197.65	280	0.0304865	8141.4	5814.8	206.07
211	0.0405031	6122.6	4371.4	197.79	281	0.0303777	8170.7	5835.8	206.18
212	0.0403109	6151.8	4392.3	197.93	282	0.0302697	8200.1	5856.8	206.28
213	0.0401206	6181.0	4413.1	198.07	283	0.0301624	8229.4	5877.8	206.38
214	0.0399320	6210.3	4434.0	198.21	284	0.0300559	8258.8	5898.8	206.49
215	0.0397452	6239.5	4454.9	198.34	285	0.0299502	8288.1	5919.9	206.59
216	0.0395602	6268.7	4475.7	198.48	286	0.0298452	8317.5	5940.9	206.69
217	0.0393769	6297.9	4496.6	198.61	287	0.0297410	8346.8	5961.9	206.80
218	0.0391953	6327.1	4517.5	198.75	288	0.0296374	8376.2	5983.0	206.90
219	0.0390153	6356.4	4538.4	198.88	289	0.0295346	8405.6	6004.0	207.00
220	0.0388371	6385.6	4559.2	199.01	290	0.0294325	8434.9	6025.0	207.10
221	0.0386604	6414.8	4580.1	199.15	291	0.0293311	8464.3	6046.1	207.20
222	0.0384854	6444.0	4601.0	199.28	292	0.0292304	8493.7	6067.1	207.30
223	0.0383119	6473.3	4621.9	199.41	293	0.0291304	8523.1	6088.2	207.40
224	0.0381400	6502.5	4642.8	199.54	294	0.0290311	8552.5	6109.2	207.50
225	0.0379696	6531.7	4663.6	199.67	295	0.0289325	8581.9	6130.3	207.60
226	0.0378008	6560.9	4684.5	199.80	296	0.0288345	8611.3	6151.4	207.70
227	0.0376335	6590.1	4705.4	199.93	297	0.0287372	8640.7	6172.5	207.80
228	0.0374676	6619.4	4726.3	200.06	298	0.0286406	8670.1	6193.5	207.90
229	0.0373032	6648.6	4747.2	200.19	299	0.0285445	8699.5	6214.6	208.00
230	0.0371403	6677.8	4768.1	200.31	300	0.0284492	8728.9	6235.7	208.10

## 1.00 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
*	90.180	35.6471	-4277.6	-4280.4	93.94				
*	90.180	0.139618	2548.2	1822.4	169.63				
91		0.138240	2573.2	1840.2	169.91				
92		0.136549	2603.6	1861.9	170.24				
93		0.134999	2634.1	1883.5	170.57				
94		0.133439	2664.4	1905.1	170.89				
95		0.131917	2694.7	1926.6	171.21				
96		0.130432	2725.0	1948.2	171.53				
97		0.128983	2755.3	1969.7	171.85				
98		0.127567	2785.5	1991.2	172.16				
99		0.126184	2815.7	2012.6	172.46				
100		0.124832	2845.8	2034.1	172.76				
			101	0.123511	2875.9	2055.5	173.06		
			102	0.122219	2906.0	2076.9	173.36		
			103	0.120955	2936.0	2098.3	173.65		
			104	0.119719	2966.1	2119.7	173.94		
			105	0.118509	2996.1	2141.0	174.23		
			106	0.117324	3026.0	2162.4	174.51		
			107	0.116164	3056.0	2183.7	174.80		
			108	0.115028	3085.9	2205.0	175.07		
			109	0.113914	3115.8	2226.3	175.35		
			110	0.112824	3145.7	2247.6	175.62		
			111	0.111754	3175.6	2268.9	175.89		
			112	0.110706	3205.4	2290.1	176.16		
			113	0.109678	3235.2	2311.4	176.43		
			114	0.108670	3265.1	2332.6	176.69		
			115	0.107680	3294.8	2353.8	176.95		
			116	0.106710	3324.6	2375.1	177.21		
			117	0.105757	3354.4	2396.3	177.46		
			118	0.104822	3384.1	2417.5	177.72		
			119	0.103904	3413.8	2438.6	177.97		
			120	0.103002	3443.6	2459.8	178.21		
			121	0.102116	3473.2	2481.0	178.46		
			122	0.101246	3502.9	2502.1	178.71		
			123	0.100391	3532.6	2523.3	178.95		
			124	0.0995518	3562.3	2544.4	179.19		
55	41.1382	-5933.2	-5935.7	71.30	125	0.0987262	3591.9	2565.5	179.43
56	40.9094	-5909.8	-5912.3	71.73	126	0.0979145	3621.5	2586.7	179.66
57	40.6959	-5883.5	-5886.0	72.19	127	0.0971164	3651.2	2607.8	179.90
58	40.4955	-5854.5	-5857.0	72.70	128	0.0963316	3680.8	2628.9	180.13
59	40.3061	-5823.1	-5825.6	73.23	129	0.0955598	3710.4	2650.0	180.36
60	40.1261	-5789.4	-5791.9	73.80	130	0.0948006	3739.9	2671.1	180.59
61	39.9538	-5753.6	-5756.1	74.39	131	0.0940536	3769.5	2692.2	180.81
62	39.7880	-5715.8	-5718.4	75.01	132	0.0933187	3799.1	2713.3	181.04
63	39.6275	-5676.3	-5678.9	75.64	133	0.0925955	3828.6	2734.3	181.26
64	39.4715	-5635.1	-5637.7	76.29	134	0.0918836	3858.2	2755.4	181.48
65	39.3191	-5592.4	-5595.0	76.95	135	0.0911830	3887.7	2776.5	181.70
66	39.1698	-5554.3	-5550.9	77.62	136	0.0904931	3917.3	2797.5	181.92
67	39.0224	-5503.0	-5505.6	78.30	137	0.0898139	3946.8	2818.6	182.14
68	38.8770	-5456.5	-5459.1	78.99	138	0.0891450	3976.3	2839.6	182.35
69	38.7330	-5409.0	-5411.6	79.68	139	0.0884863	4005.8	2860.7	182.56
70	38.5900	-5360.6	-5363.2	80.38	140	0.0878374	4035.3	2881.7	182.78
71	38.4477	-5311.2	-5313.9	81.08	141	0.0871982	4064.8	2902.7	182.99
72	38.3058	-5261.1	-5263.8	81.78	142	0.0865685	4094.3	2923.8	183.19
73	38.1642	-5210.3	-5213.0	82.48	143	0.0859479	4123.7	2944.8	183.40
74	38.0225	-5156.9	-5161.5	83.18	144	0.0853364	4153.2	2965.8	183.61
75	37.8808	-5106.9	-5109.5	83.88	145	0.0847337	4182.7	2986.8	183.81
76	37.7388	-5054.3	-5057.0	84.58	146	0.0841396	4212.1	3007.8	184.01
77	37.5963	-5001.3	-5004.0	85.27	147	0.0835540	4241.6	3028.8	184.21
78	37.4534	-4948.0	-4950.7	85.96	148	0.0829766	4271.0	3049.8	184.41
79	37.3099	-4894.2	-4896.9	86.64	149	0.0824073	4300.4	3070.8	184.61
80	37.1657	-4840.1	-4842.8	87.32	150	0.0818459	4329.9	3091.8	184.81
81	37.0208	-4785.7	-4788.5	88.00	151	0.0812922	4359.3	3112.8	185.00
82	36.8751	-4731.1	-4733.8	88.67	152	0.0807461	4388.7	3133.8	185.20
83	36.7285	-4676.2	-4679.0	89.33	153	0.0802074	4418.1	3154.8	185.39
84	36.5810	-4621.2	-4623.9	89.99	154	0.0796760	4447.5	3175.8	185.58
85	36.4326	-4565.9	-4568.7	90.65	155	0.0791517	4476.9	3196.7	185.77
86	36.2832	-4510.5	-4513.3	91.30	156	0.0786343	4506.3	3217.7	185.96
87	36.1328	-4455.0	-4457.8	91.94	157	0.0781238	4535.7	3238.7	186.15
88	35.9813	-4399.3	-4402.1	92.57	158	0.0776200	4565.1	3259.7	186.34
89	35.8287	-4343.5	-4346.3	93.21	159	0.0771227	4594.5	3280.6	186.52
90	35.6749	-4287.6	-4290.5	93.83	160	0.0766319	4623.8	3301.6	186.71

\* PHASE CHANGE

## 1.00 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
161	0.0761474	4653.2	3322.5	186.89	231	0.0528562	6703.3	4786.2	197.46
162	0.0756690	4682.6	3343.5	187.07	232	0.0526269	6732.5	4807.1	197.59
163	0.0751968	4712.0	3364.4	187.25	233	0.0523996	6761.8	4828.0	197.71
164	0.0747304	4741.3	3385.4	187.43	234	0.0521742	6791.0	4848.9	197.84
165	0.0742699	4770.7	3406.3	187.61	235	0.0519508	6820.3	4869.8	197.96
166	0.0738151	4800.0	3427.3	187.79	236	0.0517293	6849.6	4890.7	198.09
167	0.0733659	4829.4	3448.2	187.96	237	0.0515096	6878.8	4911.7	198.21
168	0.0729223	4858.7	3469.2	188.14	238	0.0512919	6908.1	4932.6	198.34
169	0.0724840	4888.0	3490.1	188.31	239	0.0510760	6937.3	4953.5	198.46
170	0.0720510	4917.4	3511.1	188.49	240	0.0508619	6966.6	4974.4	198.58
171	0.0716233	4946.7	3532.0	188.66	241	0.0506496	6995.9	4995.3	198.70
172	0.0712006	4976.0	3552.9	188.83	242	0.0504391	7025.1	5016.2	198.82
173	0.0707830	5005.4	3573.8	189.00	243	0.0502303	7054.4	5037.1	198.94
174	0.0703703	5034.7	3594.8	189.17	244	0.0500233	7083.7	5058.1	199.06
175	0.0699625	5064.0	3615.7	189.34	245	0.0498180	7112.9	5079.0	199.18
176	0.0695594	5093.3	3636.6	189.50	246	0.0496143	7142.2	5099.9	199.30
177	0.0691610	5122.7	3657.5	189.67	247	0.0494124	7171.5	5120.8	199.42
178	0.0687671	5152.0	3678.5	189.83	248	0.0492120	7200.8	5141.8	199.54
179	0.0683778	5181.3	3699.4	190.00	249	0.0490133	7230.0	5162.7	199.66
180	0.0679929	5210.6	3720.3	190.16	250	0.0488162	7259.3	5183.6	199.78
181	0.0676124	5239.9	3741.2	190.32	251	0.0486207	7288.6	5204.6	199.89
182	0.0672362	5269.2	3762.1	190.48	252	0.0484268	7317.9	5225.5	200.01
183	0.0668641	5298.5	3783.1	190.65	253	0.0482344	7347.2	5246.4	200.13
184	0.0664962	5327.8	3804.0	190.81	254	0.0480435	7376.4	5267.4	200.24
185	0.0661324	5357.1	3824.9	190.96	255	0.0478561	7405.7	5288.3	200.36
186	0.0657726	5386.4	3845.8	191.12	256	0.0476663	7435.0	5309.2	200.47
187	0.0654167	5415.7	3866.7	191.28	257	0.0474799	7464.3	5330.2	200.58
188	0.0650646	5444.9	3887.6	191.43	258	0.0472950	7493.6	5351.1	200.70
189	0.0647164	5474.2	3908.5	191.59	259	0.0471115	7522.9	5372.1	200.81
190	0.0643719	5503.5	3929.4	191.74	260	0.0469294	7552.2	5393.0	200.92
191	0.0640311	5532.8	3950.3	191.90	261	0.0467488	7581.5	5414.0	201.04
192	0.0636940	5562.1	3971.2	192.05	262	0.0465595	7610.8	5435.0	201.15
193	0.0633603	5591.4	3992.1	192.20	263	0.0463916	7640.1	5455.9	201.26
194	0.0630302	5620.6	4013.0	192.35	264	0.0462151	7669.4	5476.9	201.37
195	0.0627036	5649.9	4033.9	192.51	265	0.0460399	7698.7	5497.8	201.48
196	0.0623803	5679.2	4054.8	192.66	266	0.0458660	7728.0	5518.8	201.59
197	0.0620604	5708.5	4075.7	192.80	267	0.0456935	7757.3	5539.8	201.70
198	0.0617438	5737.7	4096.6	192.95	268	0.0455222	7786.7	5560.8	201.81
199	0.0614305	5767.0	4117.5	193.10	269	0.0453523	7816.0	5581.7	201.92
200	0.0611203	5796.3	4138.4	193.25	270	0.0451836	7845.3	5602.7	202.03
201	0.0608132	5825.5	4159.3	193.39	271	0.0450161	7874.6	5623.7	202.14
202	0.0605093	5854.8	4180.2	193.54	272	0.0448499	7903.9	5644.7	202.25
203	0.0602084	5884.1	4201.1	193.68	273	0.0446850	7933.3	5665.7	202.35
204	0.0599105	5913.3	4222.0	193.83	274	0.0445212	7962.6	5686.7	202.46
205	0.0596156	5942.6	4242.9	193.97	275	0.0443587	7991.9	5707.7	202.57
206	0.0593235	5971.8	4263.8	194.11	276	0.0441973	8021.3	5728.7	202.68
207	0.0590344	6001.1	4284.7	194.25	277	0.0440371	8050.6	5749.7	202.78
208	0.0587480	6030.4	4305.6	194.39	278	0.0438780	8080.0	5770.7	202.89
209	0.0584645	6059.6	4326.5	194.53	279	0.0437202	8109.3	5791.7	202.99
210	0.0581837	6088.9	4347.4	194.67	280	0.0435634	8138.7	5812.7	203.10
211	0.0579056	6118.1	4368.3	194.81	281	0.0434078	8168.0	5833.7	203.20
212	0.0576302	6147.4	4389.2	194.95	282	0.0432533	8197.4	5854.7	203.31
213	0.0573574	6176.7	4410.1	195.09	283	0.0430999	8226.8	5875.8	203.41
214	0.0570871	6205.9	4430.9	195.23	284	0.0429475	8256.1	5896.8	203.51
215	0.0568195	6235.2	4451.8	195.36	285	0.0427963	8285.5	5917.8	203.62
216	0.0565543	6264.4	4472.7	195.50	286	0.0426461	8314.9	5938.9	203.72
217	0.0562916	6293.7	4493.6	195.63	287	0.0424970	8344.2	5959.9	203.82
218	0.0560314	6322.9	4514.5	195.77	288	0.0423489	8373.6	5980.9	203.93
219	0.0557736	6352.2	4535.4	195.90	289	0.0422018	8403.0	6002.0	204.03
220	0.0555182	6381.4	4556.3	196.04	290	0.0420558	8432.4	6023.0	204.13
221	0.0552651	6410.7	4577.2	196.17	291	0.0419108	8461.8	6044.1	204.23
222	0.0550143	6440.0	4598.1	196.30	292	0.0417667	8491.2	6065.1	204.33
223	0.0547658	6469.2	4619.0	196.43	293	0.0416237	8520.6	6086.2	204.43
224	0.0545195	6498.5	4639.9	196.56	294	0.0414816	8550.0	6107.3	204.53
225	0.0542755	6527.7	4660.8	196.69	295	0.0413406	8579.4	6128.4	204.63
226	0.0540336	6557.0	4681.7	196.82	296	0.0412004	8608.8	6149.4	204.73
227	0.0537940	6586.2	4702.6	196.95	297	0.0410612	8638.2	6170.5	204.83
228	0.0535564	6615.5	4723.5	197.08	298	0.0409230	8667.7	6191.6	204.93
229	0.0533209	6644.7	4744.4	197.21	299	0.0407857	8697.1	6212.7	205.03
230	0.0530875	6674.0	4765.3	197.34	300	0.0406693	8726.5	6233.8	205.13

## 4.00 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
91		35.5416	-4226.5	-4237.9	94.41				
92		35.3860	-4170.5	-4182.0	95.02				
93		35.2291	-4114.5	-4126.0	95.63				
94		35.0710	-4058.3	-4069.9	96.23				
95		34.9115	-4002.1	-4013.8	96.82				
96		34.7507	-3945.9	-3957.6	97.41				
97		34.5884	-3889.6	-3901.3	98.00				
98		34.4247	-3833.3	-3845.0	98.57				
99		34.2595	-3776.8	-3788.7	99.15				
100		34.0927	-3720.4	-3732.3	99.71				
101		33.9243	-3663.8	-3675.8	100.28				
102		33.7542	-3607.2	-3619.2	100.83				
103		33.5824	-3550.5	-3562.6	101.39				
104		33.4087	-3493.7	-3505.9	101.94				
105		33.2332	-3436.9	-3449.1	102.48				
* 105.903	33.0729	-3385.4	-3397.7	-3409.9	102.97				
* 105.903	0.504035	2855.1	2051.0	161.89					
106	0.503435	2858.4	2053.3	161.93					
107	0.497326	2892.0	2077.0	162.24					
108	0.491399	2925.4	2100.5	162.55					
109	0.485643	2958.6	2124.0	162.86					
110	0.480049	2991.7	2147.4	163.16					
111	0.474609	3024.6	2170.6	163.46					
112	0.469316	3057.4	2193.8	163.75					
113	0.464163	3090.1	2216.9	164.04					
114	0.459142	3122.7	2239.9	164.33					
115	0.454249	3155.1	2262.9	164.61					
116	0.449678	3187.5	2285.7	164.89					
117	0.444823	3219.7	2308.5	165.17					
118	0.440279	3251.8	2331.3	165.44					
119	0.435842	3283.9	2353.9	165.71					
120	0.431508	3315.8	2376.5	165.98					
121	0.427272	3347.7	2399.1	166.25					
122	0.423130	3379.5	2421.6	166.51					
123	0.419080	3411.2	2444.1	166.77					
124	0.415117	3442.9	2466.5	167.02					
125	0.411238	3474.4	2488.9	167.28					
126	0.407441	3505.9	2511.2	167.53					
127	0.403723	3537.4	2533.4	167.78					
128	0.400080	3568.8	2555.7	168.02					
129	0.396510	3600.1	2577.9	168.27					
130	0.393011	3631.3	2600.0	168.51					
61	39.9645	-5747.9	-5758.1	74.36	131	0.389581	3662.5	2622.2	168.75
62	39.7990	-5710.1	-5720.3	74.97	132	0.386216	3693.7	2644.3	168.98
63	39.6389	-5670.6	-5680.8	75.61	133	0.382916	3724.8	2666.3	169.22
64	39.4832	-5629.3	-5639.6	76.26	134	0.379677	3755.9	2688.3	169.45
65	39.3310	-5586.6	-5596.9	76.92	135	0.376499	3788.6	2710.3	169.68
66	39.1818	-5542.5	-5552.9	77.59	136	0.373379	3817.8	2732.3	169.91
67	39.0349	-5497.2	-5507.6	78.27	137	0.370315	3848.7	2754.2	170.14
68	38.8898	-5450.7	-5461.1	78.96	138	0.367306	3879.6	2776.2	170.36
69	38.7460	-5403.2	-5413.6	79.66	139	0.364350	3910.5	2798.0	170.58
70	38.6033	-5354.7	-5365.2	80.35	140	0.361446	3941.3	2819.9	170.80
71	38.4613	-5305.4	-5315.9	81.05	141	0.358592	3972.0	2841.7	171.02
72	38.3198	-5255.3	-5265.9	81.75	142	0.355787	4002.7	2863.5	171.24
73	38.1784	-5204.5	-5215.1	82.45	143	0.353029	4033.4	2885.3	171.46
74	38.0371	-5153.1	-5163.7	83.15	144	0.350318	4064.1	2907.1	171.67
75	37.8957	-5101.1	-5111.8	83.85	145	0.347651	4094.7	2928.8	171.88
76	37.7540	-5048.6	-5059.3	84.55	146	0.345028	4125.3	2950.5	172.09
77	37.6119	-4995.6	-5006.4	85.24	147	0.342447	4155.8	2972.2	172.30
78	37.4693	-4942.3	-4953.1	85.93	148	0.339907	4186.3	2993.9	172.51
79	37.3262	-4888.5	-4899.4	86.61	149	0.337408	4216.8	3015.6	172.71
80	37.1824	-4834.5	-4845.4	87.29	150	0.334949	4247.3	3037.2	172.92
81	37.0378	-4780.1	-4791.1	87.97	151	0.332527	4277.7	3058.9	173.12
82	36.8925	-4725.5	-4736.5	88.64	152	0.330143	4308.2	3080.5	173.32
83	36.7463	-4670.7	-4681.7	89.30	153	0.327795	4338.5	3102.1	173.52
84	36.5993	-4615.7	-4626.7	89.96	154	0.325483	4368.9	3123.6	173.72
85	36.4513	-4560.5	-4571.6	90.61	155	0.323205	4399.2	3145.2	173.91
86	36.3024	-4505.1	-4516.3	91.26	156	0.320961	4429.5	3166.7	174.11
87	36.1524	-4449.6	-4460.8	91.90	157	0.318750	4459.8	3188.3	174.30
88	36.0014	-4394.0	-4405.2	92.54	158	0.316572	4490.1	3209.8	174.49
89	35.8492	-4338.2	-4349.6	93.17	159	0.314424	4520.3	3231.3	174.68
90	35.6960	-4282.4	-4293.8	93.79	160	0.312308	4550.6	3252.8	174.87

• PHASE CHANGE

## 4.00 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
161	0.310221	4580.8	3274.2	175.06	231	0.212607	6665.2	4758.8	185.82
162	0.308164	4610.9	3295.7	175.25	232	0.211667	6694.7	4779.8	185.95
163	0.306136	4641.1	3317.2	175.43	233	0.210734	6724.2	4800.9	186.07
164	0.304136	4671.3	3338.6	175.62	234	0.209810	6753.8	4822.0	186.20
165	0.302163	4701.4	3360.0	175.80	235	0.208895	6783.3	4843.1	186.32
166	0.300217	4731.5	3381.4	175.98	236	0.207987	6812.9	4864.1	186.45
167	0.298298	4761.6	3402.8	176.16	237	0.207088	6842.4	4885.2	186.58
168	0.296404	4791.6	3424.2	176.34	238	0.206196	6871.9	4906.3	186.70
169	0.294535	4821.7	3445.6	176.52	239	0.205312	6901.5	4927.3	186.82
170	0.292691	4851.7	3467.0	176.70	240	0.204436	6931.0	4948.4	186.95
171	0.290871	4881.8	3488.3	176.87	241	0.203568	6960.5	4969.5	187.07
172	0.289075	4911.8	3509.7	177.05	242	0.202707	6990.0	4990.6	187.19
173	0.287302	4941.8	3531.0	177.22	243	0.201853	7019.6	5011.6	187.31
174	0.285551	4971.8	3552.4	177.40	244	0.201007	7049.1	5032.7	187.43
175	0.283823	5001.7	3573.7	177.57	245	0.200168	7078.6	5053.8	187.56
176	0.282116	5031.7	3595.0	177.74	246	0.199336	7108.1	5074.8	187.68
177	0.280431	5061.6	3616.3	177.91	247	0.198511	7137.6	5095.9	187.80
178	0.278767	5091.5	3637.6	178.08	248	0.197693	7167.2	5117.0	187.91
179	0.277124	5121.4	3658.9	178.24	249	0.196882	7196.7	5138.0	188.03
180	0.275500	5151.3	3680.2	178.41	250	0.196077	7226.2	5159.1	188.15
181	0.273896	5181.2	3701.4	178.58	251	0.195279	7255.7	5180.2	188.27
182	0.272312	5211.1	3722.7	178.74	252	0.194488	7285.2	5201.2	188.39
183	0.270747	5241.0	3744.0	178.91	253	0.193704	7314.7	5222.3	188.50
184	0.269200	5270.8	3765.2	179.07	254	0.192925	7344.2	5243.4	188.62
185	0.267672	5300.7	3786.5	179.23	255	0.192153	7373.8	5264.4	188.74
186	0.266161	5330.5	3807.7	179.39	256	0.191388	7403.3	5285.5	188.85
187	0.264668	5360.3	3828.9	179.55	257	0.190628	7432.8	5306.6	188.97
188	0.263193	5390.1	3850.1	179.71	258	0.189875	7462.3	5327.7	189.08
189	0.261734	5419.9	3871.4	179.87	259	0.189127	7491.8	5348.7	189.20
190	0.260292	5449.7	3892.6	180.02	260	0.188386	7521.3	5369.8	189.31
191	0.258867	5479.5	3913.8	180.18	261	0.187650	7550.8	5390.9	189.42
192	0.257458	5509.3	3935.0	180.34	262	0.186921	7580.3	5412.0	189.54
193	0.256064	5539.0	3956.2	180.49	263	0.186197	7609.8	5433.1	189.65
194	0.254686	5568.8	3977.4	180.64	264	0.185479	7639.3	5454.1	189.76
195	0.253324	5598.5	3998.6	180.80	265	0.184766	7668.9	5475.2	189.87
196	0.251976	5628.3	4019.7	180.95	266	0.184059	7698.4	5496.3	189.98
197	0.250643	5658.0	4040.9	181.10	267	0.183357	7727.9	5517.4	190.09
198	0.249325	5687.7	4062.1	181.25	268	0.182661	7757.4	5538.5	190.20
199	0.248021	5717.4	4083.2	181.40	269	0.181970	7786.9	5559.6	190.31
200	0.246731	5747.1	4104.4	181.55	270	0.181284	7816.4	5580.7	190.42
201	0.245454	5776.8	4125.6	181.70	271	0.180604	7845.9	5601.7	190.53
202	0.244192	5806.5	4146.7	181.85	272	0.179929	7875.5	5622.8	190.64
203	0.242942	5836.2	4167.9	181.99	273	0.179259	7905.0	5643.9	190.75
204	0.241706	5865.9	4189.0	182.14	274	0.178593	7934.5	5665.0	190.86
205	0.240483	5895.6	4210.1	182.28	275	0.177933	7964.0	5686.1	190.96
206	0.239272	5925.2	4231.3	182.43	276	0.177278	7993.5	5707.2	191.07
207	0.238074	5954.9	4252.4	182.57	277	0.176628	8023.1	5728.4	191.18
208	0.236888	5984.5	4273.5	182.71	278	0.175982	8052.6	5749.5	191.29
209	0.235714	6014.2	4294.7	182.86	279	0.175342	8082.1	5770.6	191.39
210	0.234552	6043.8	4315.8	183.00	280	0.174706	8111.6	5791.7	191.50
211	0.233402	6073.4	4336.9	183.14	281	0.174074	8141.2	5812.8	191.60
212	0.232264	6103.1	4358.0	183.28	282	0.173448	8170.7	5833.9	191.71
213	0.231136	6132.7	4379.1	183.42	283	0.172826	8200.2	5855.0	191.81
214	0.230020	6162.3	4400.3	183.56	284	0.172208	8229.8	5876.2	191.92
215	0.228915	6191.9	4421.4	183.69	285	0.171595	8259.3	5897.3	192.02
216	0.227821	6221.5	4442.5	183.83	286	0.170986	8288.9	5918.4	192.12
217	0.226738	6251.1	4463.6	183.97	287	0.170381	8318.4	5939.6	192.23
218	0.225665	6280.7	4484.7	184.10	288	0.169781	8347.9	5960.7	192.33
219	0.224602	6310.3	4505.8	184.24	289	0.169186	8377.5	5981.8	192.43
220	0.223550	6339.9	4526.9	184.38	290	0.168594	8407.0	6003.0	192.53
221	0.222508	6369.5	4547.9	184.51	291	0.168006	8436.6	6024.1	192.63
222	0.221475	6399.1	4569.0	184.64	292	0.167423	8466.1	6045.3	192.74
223	0.220453	6428.7	4590.1	184.78	293	0.166844	8495.7	6066.4	192.84
224	0.219440	6458.2	4611.2	184.91	294	0.166269	8525.3	6087.6	192.94
225	0.218436	6487.8	4632.3	185.04	295	0.165697	8554.8	6108.7	193.04
226	0.217442	6517.4	4653.4	185.17	296	0.165130	8584.4	6129.9	193.14
227	0.216457	6546.9	4674.5	185.30	297	0.164567	8614.0	6151.1	193.24
228	0.215481	6576.5	4695.5	185.43	298	0.164007	8643.5	6172.2	193.34
229	0.214515	6606.1	4716.6	185.56	299	0.163452	8673.1	6193.4	193.44
230	0.213557	6635.6	4737.7	185.69	300	0.162900	8702.7	6214.6	193.54

## 7.00 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
91		35.5631	-4221.3		92	35.4080	-4165.4	-4185.4	94.98
					93	35.2518	-4109.4	-4129.5	95.59
					94	35.0942	-4053.3	-4073.6	96.19
					95	34.9354	-3997.2	-4017.5	96.78
					96	34.7752	-3941.1	-3961.4	97.37
					97	34.6136	-3884.8	-3905.3	97.95
					98	34.4506	-3828.5	-3849.1	98.53
					99	34.2861	-3772.2	-3792.9	99.10
					100	34.1201	-3715.8	-3736.6	99.67
					101	33.9525	-3659.4	-3680.3	100.23
					102	33.7832	-3602.9	-3623.8	100.79
					103	33.6122	-3546.3	-3567.4	101.34
					104	33.4395	-3489.6	-3510.8	101.89
					105	33.2648	-3432.8	-3454.1	102.43
					106	33.0883	-3375.9	-3397.4	102.97
					107	32.9097	-3318.9	-3340.5	103.51
					108	32.7290	-3261.8	-3283.5	104.04
					109	32.5461	-3204.5	-3226.3	104.57
					110	32.3609	-3147.0	-3169.0	105.09
					111	32.1733	-3089.4	-3111.4	105.61
					112	31.9831	-3031.5	-3053.7	106.13
					113	31.7902	-2973.3	-2995.6	106.65
					114	31.5944	-2914.9	-2937.4	107.16
*	114.011	31.5921	-2914.2		*	114.011	0.858467	-2936.7	107.17
*	114.011	0.858467	2957.4			115	0.847419	2993.5	2131.1
						116	0.836630	3029.8	2156.5
						117	0.826205	3065.7	2182.0
						118	0.816121	3101.4	2207.2
						119	0.806358	3136.9	2232.3
						120	0.796896	3172.1	2257.2
								2282.0	159.91
									160.21
									160.50
					121	0.787719	3207.0	2306.6	160.80
					122	0.778811	3241.8	2331.0	161.08
					123	0.770157	3276.3	2355.4	161.36
					124	0.761745	3310.7	2379.6	161.64
55	41.1558	-5923.1	-5940.4	71.22	125	0.753562	3344.9	2403.6	161.92
56	40.9277	-5899.4	-5916.7	71.65	126	0.745597	3378.9	2427.6	162.19
57	40.7149	-5872.9	-5890.3	72.12	127	0.737839	3412.8	2451.5	162.45
58	40.5151	-5843.7	-5861.2	72.62	128	0.730279	3446.5	2475.2	162.72
59	40.3264	-5812.1	-5829.7	73.16	129	0.722908	3480.0	2498.9	162.98
60	40.1469	-5778.2	-5795.9	73.73	130	0.715717	3513.5	2522.4	163.24
61	39.9752	-5742.3	-5760.0	74.33	131	0.708698	3546.8	2545.9	163.49
62	39.8100	-5704.4	-5722.3	74.94	132	0.701845	3579.9	2569.3	163.75
63	39.6502	-5664.8	-5682.7	75.58	133	0.695151	3613.0	2592.6	164.00
64	39.4967	-5623.6	-5641.5	76.23	134	0.688608	3645.9	2615.9	164.24
65	39.3429	-5580.8	-5598.8	76.89	135	0.682211	3678.8	2639.1	164.49
66	39.1939	-5536.7	-5554.0	77.56	136	0.675954	3711.5	2662.2	164.73
67	39.0473	-5491.3	-5509.5	78.24	137	0.669832	3744.1	2685.2	164.97
68	38.9025	-5444.9	-5463.1	78.93	138	0.663840	3776.7	2708.2	165.20
69	38.7590	-5397.3	-5415.6	79.63	139	0.659793	3809.1	2731.1	165.44
70	38.6166	-5348.9	-5367.2	80.32	140	0.652226	3841.5	2754.0	165.67
71	38.4749	-5299.6	-5318.0	81.02	141	0.646595	3873.8	2776.8	165.90
72	38.3336	-5249.5	-5268.0	81.72	142	0.641077	3906.0	2799.6	166.13
73	38.1926	-5198.7	-5217.3	82.42	143	0.635667	3938.1	2822.3	166.35
74	38.0516	-5147.3	-5165.9	83.12	144	0.630362	3970.1	2844.9	166.58
75	37.9105	-5095.3	-5114.0	83.82	145	0.625158	4002.1	2867.5	166.80
76	37.7691	-5042.8	-5061.6	84.52	146	0.620052	4034.0	2890.1	167.02
77	37.6274	-4989.9	-5008.7	85.21	147	0.615041	4065.9	2912.6	167.23
78	37.4852	-4936.6	-4955.5	85.90	148	0.610121	4097.7	2935.1	167.45
79	37.3424	-4882.9	-4901.8	86.58	149	0.605291	4129.4	2957.6	167.66
80	37.1989	-4828.8	-4847.9	87.26	150	0.600547	4161.0	2980.0	167.87
81	37.0548	-4774.5	-4793.7	87.94	151	0.595886	4192.6	3002.3	168.08
82	36.9099	-4720.0	-4739.2	88.60	152	0.591307	4224.2	3024.7	168.29
83	36.7641	-4665.2	-4684.5	89.27	153	0.586807	4255.7	3046.9	168.50
84	36.6175	-4610.2	-4629.5	89.93	154	0.582383	4287.1	3069.2	168.70
85	36.4699	-4555.0	-4574.5	90.58	155	0.578033	4318.5	3091.4	168.91
86	36.3214	-4499.7	-4519.2	91.23	156	0.573756	4349.9	3113.6	169.11
87	36.1719	-4444.2	-4463.8	91.87	157	0.569549	4381.2	3135.8	169.31
88	36.0214	-4388.7	-4408.3	92.50	158	0.565410	4412.4	3157.9	169.51
89	35.8697	-4333.0	-4352.7	93.13	159	0.561338	4443.6	3180.1	169.70
90	35.7170	-4277.2	-4297.1	93.76	160	0.557331	4474.8	3202.1	169.90

• PHASE CHANGE

## 7.00 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTHOPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
161	0.553386	4505.9	3224.2	170.09	231	0.374154	6626.8	4731.1	181.05
162	0.549503	4537.0	3246.2	170.29	232	0.372466	6656.7	4752.4	181.17
163	0.545680	4568.1	3268.2	170.48	233	0.370793	6686.5	4773.6	181.30
164	0.541915	4599.1	3290.2	170.67	234	0.369136	6716.3	4794.8	181.43
165	0.538207	4630.0	3312.2	170.86	235	0.367494	6746.2	4816.1	181.56
166	0.534554	4661.0	3334.1	171.04	236	0.365868	6776.0	4837.3	181.68
167	0.530956	4691.9	3356.0	171.23	237	0.364256	6805.8	4858.6	181.81
168	0.527410	4722.8	3377.9	171.41	238	0.362659	6835.6	4879.8	181.94
169	0.523916	4753.6	3399.8	171.60	239	0.361076	6865.4	4901.0	182.06
170	0.520472	4784.4	3421.6	171.78	240	0.359507	6895.2	4922.3	182.18
171	0.517077	4815.2	3443.4	171.96	241	0.357953	6925.0	4943.5	182.31
172	0.513729	4845.9	3465.2	172.14	242	0.356412	6954.8	4964.7	182.43
173	0.510429	4876.6	3487.0	172.31	243	0.354885	6984.6	4985.9	182.56
174	0.507175	4907.3	3508.8	172.49	244	0.353372	7014.4	5007.1	182.68
175	0.503965	4938.0	3530.6	172.67	245	0.351872	7044.1	5028.4	182.80
176	0.500799	4968.6	3552.3	172.84	246	0.350384	7073.9	5049.6	182.92
177	0.497676	4999.2	3574.0	173.02	247	0.348910	7103.7	5070.8	183.04
178	0.494595	5029.8	3595.7	173.19	248	0.347449	7133.4	5092.0	183.16
179	0.491559	5060.4	3617.4	173.36	249	0.346000	7163.2	5113.2	183.28
180	0.488554	5090.9	3639.1	173.53	250	0.344564	7193.0	5134.4	183.40
181	0.485593	5121.4	3660.7	173.70	251	0.343139	7222.7	5155.6	183.52
182	0.482670	5151.9	3682.4	173.87	252	0.341727	7252.5	5176.8	183.64
183	0.479785	5182.4	3704.0	174.03	253	0.340327	7282.2	5198.0	183.76
184	0.476937	5212.8	3725.6	174.20	254	0.338939	7311.9	5219.3	183.87
185	0.474125	5243.2	3747.2	174.36	255	0.337562	7341.7	5240.5	183.99
186	0.471348	5273.6	3768.8	174.53	256	0.336197	7371.4	5261.7	184.11
187	0.466606	5304.0	3790.4	174.69	257	0.334843	7401.2	5282.9	184.22
188	0.465897	5334.4	3812.0	174.85	258	0.333500	7430.9	5304.1	184.34
189	0.463222	5364.7	3833.5	175.01	259	0.332168	7460.6	5325.3	184.45
190	0.460580	5395.1	3855.1	175.17	260	0.330848	7490.3	5346.5	184.57
191	0.457969	5425.4	3876.6	175.33	261	0.329538	7520.1	5367.7	184.68
192	0.455390	5455.7	3898.1	175.49	262	0.328238	7549.8	5388.9	184.79
193	0.452841	5485.9	3919.6	175.65	263	0.326949	7579.5	5410.1	184.91
194	0.450323	5516.2	3941.1	175.80	264	0.325671	7609.2	5431.3	185.02
195	0.447834	5546.4	3962.6	175.96	265	0.324402	7638.9	5452.5	185.13
196	0.445375	5576.7	3984.1	176.11	266	0.323144	7668.7	5473.7	185.24
197	0.442933	5606.9	4005.5	176.27	267	0.321896	7698.4	5494.9	185.36
198	0.440540	5637.1	4027.0	176.42	268	0.320657	7728.1	5516.1	185.47
199	0.438164	5667.2	4048.4	176.57	269	0.319429	7757.8	5537.3	185.58
200	0.435816	5697.4	4069.9	176.72	270	0.318210	7787.5	5558.5	185.69
201	0.433493	5727.5	4091.3	176.87	271	0.317000	7817.2	5579.7	185.80
202	0.431197	5757.7	4112.7	177.02	272	0.315800	7846.9	5600.9	185.91
203	0.428926	5787.8	4134.1	177.17	273	0.314609	7876.6	5622.1	186.02
204	0.426681	5817.9	4155.6	177.32	274	0.313428	7906.4	5643.3	186.13
205	0.424460	5848.0	4177.0	177.47	275	0.312255	7936.1	5664.5	186.23
206	0.422263	5878.1	4198.3	177.61	276	0.311091	7965.8	5685.8	186.34
207	0.420090	5908.2	4219.7	177.76	277	0.309937	7995.5	5707.0	186.45
208	0.417941	5938.2	4241.1	177.90	278	0.308741	8025.2	5728.2	186.56
209	0.415814	5968.3	4262.5	178.05	279	0.307653	8054.9	5749.4	186.66
210	0.413710	5998.3	4283.8	178.19	280	0.306524	8084.6	5770.6	186.77
211	0.411629	6028.3	4305.2	178.34	281	0.305404	8114.3	5791.8	186.87
212	0.409569	6058.3	4326.5	178.48	282	0.304292	8144.0	5813.0	186.98
213	0.407531	6088.3	4347.9	178.62	283	0.303188	8173.7	5834.3	187.09
214	0.405513	6118.3	4369.2	178.76	284	0.302093	8203.4	5855.5	187.19
215	0.403517	6148.3	4390.5	178.90	285	0.301005	8233.1	5876.7	187.29
216	0.401541	6178.3	4411.9	179.04	286	0.299925	8262.8	5897.9	187.40
217	0.399586	6208.2	4433.2	179.18	287	0.298854	8292.5	5919.2	187.50
218	0.397650	6238.2	4454.5	179.31	288	0.297790	8322.3	5940.4	187.61
219	0.395734	6268.1	4475.8	179.45	289	0.296734	8352.0	5961.6	187.71
220	0.393837	6298.1	4497.1	179.59	290	0.295685	8381.7	5982.9	187.81
221	0.391958	6328.0	4518.4	179.72	291	0.294644	8411.4	6004.1	187.91
222	0.390099	6357.9	4539.7	179.86	292	0.293611	8441.1	6025.4	188.02
223	0.388258	6387.8	4561.0	179.99	293	0.292585	8470.8	6046.6	188.12
224	0.386434	6417.7	4582.2	180.13	294	0.291566	8500.5	6067.8	188.22
225	0.384629	6447.6	4603.5	180.26	295	0.290554	8530.3	6089.1	188.32
226	0.382841	6477.5	4624.8	180.39	296	0.289550	8560.0	6110.3	188.42
227	0.381070	6507.4	4646.1	180.52	297	0.288552	8589.7	6131.6	188.52
228	0.379316	6537.3	4667.3	180.65	298	0.287562	8619.4	6152.9	188.62
229	0.377579	6567.1	4688.6	180.79	299	0.286578	8649.2	6174.1	188.72
230	0.375859	6597.0	4709.9	180.92	300	0.285602	8678.9	6195.4	188.82

## 10.00 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K	TEMP. K	DFNSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
91	35.5845	-4216.2	-4244.6	94.34					
92	35.4300	-4160.3	-4188.9	94.95					
93	35.2743	-4104.3	-4133.1	95.55					
94	35.1173	-4048.3	-4077.2	96.15					
95	34.9591	-3992.3	-4021.3	96.74					
96	34.7995	-3936.2	-3965.3	97.33					
97	34.6386	-3880.0	-3909.3	97.91					
98	34.4763	-3823.8	-3853.2	98.49					
99	34.3125	-3767.6	-3797.1	99.06					
100	34.1472	-3711.3	-3740.9	99.63					
101	33.9804	-3654.9	-3684.7	100.19					
102	33.8119	-3598.5	-3628.4	100.74					
103	33.6418	-3542.0	-3572.1	101.29					
104	33.4699	-3485.4	-3515.7	101.84					
105	33.2962	-3428.7	-3459.2	102.38					
106	33.1207	-3372.0	-3402.5	102.92					
107	32.9431	-3315.1	-3345.8	103.46					
108	32.7635	-3258.1	-3289.0	103.99					
109	32.5818	-3200.9	-3232.0	104.51					
110	32.3978	-3143.6	-3174.8	105.04					
111	32.2114	-3086.1	-3117.5	105.56					
112	32.0226	-3028.3	-3060.0	106.07					
113	31.8311	-2970.3	-3002.2	106.59					
114	31.6369	-2912.1	-2944.1	107.10					
115	31.4397	-2853.6	-2885.8	107.61					
116	31.2394	-2794.7	-2827.1	108.12					
117	31.0359	-2735.4	-2768.1	108.63					
118	30.8289	-2675.7	-2708.6	109.14					
119	30.6182	-2615.6	-2648.7	109.65					
* 119.860	30.4338	-2563.5	-2596.8	110.09					
* 119.860	1.21725	2999.9	2167.5	156.50					
120	1.21470	3005.5	2171.4	156.55					
121	1.19769	3045.2	2199.1	156.88					
122	1.18129	3084.3	2226.6	157.20					
123	1.16552	3123.0	2253.7	157.52					
124	1.15034	3161.3	2280.5	157.83					
55	41.1645	-5916.1	-5942.7	71.18					
56	40.9368	-5894.2	-5919.0	71.61					
57	40.7244	-5867.6	-5892.4	72.08					
58	40.5249	-5838.3	-5863.3	72.59					
59	40.3365	-5806.6	-5831.7	73.13					
60	40.1573	-5772.6	-5797.9	73.70					
61	39.9859	-5736.6	-5762.0	74.30					
62	39.8210	-5698.7	-5724.2	74.91					
63	39.6615	-5659.1	-5684.6	75.55					
64	39.5063	-5617.8	-5643.4	76.20					
65	39.3547	-5575.0	-5600.7	76.86					
66	39.2061	-5530.9	-5556.7	77.53					
67	39.0597	-5485.5	-5511.4	78.22					
68	38.9152	-5439.0	-5465.0	78.90					
69	38.7720	-5391.5	-5417.6	79.60					
70	38.6299	-5343.0	-5369.2	80.30					
71	38.4885	-5293.7	-5320.0	80.99					
72	38.3475	-5243.6	-5270.1	81.70					
73	38.2068	-5192.9	-5219.4	82.40					
74	38.0661	-5141.5	-5168.1	83.09					
75	37.9253	-5089.5	-5116.2	83.79					
76	37.7843	-5037.1	-5063.9	84.49					
77	37.6428	-4984.2	-5011.1	85.18					
78	37.5010	-4930.8	-4957.9	85.87					
79	37.3585	-4877.2	-4904.3	86.55					
80	37.2155	-4823.2	-4850.4	87.23					
81	37.0717	-4768.9	-4796.2	87.90					
82	36.9271	-4714.4	-4741.8	88.57					
83	36.7818	-4659.6	-4687.2	89.24					
84	36.6356	-4604.7	-4632.3	89.89					
85	36.4884	-4549.5	-4577.3	90.55					
86	36.3404	-4494.3	-4522.2	91.19					
87	36.1913	-4438.9	-4466.9	91.83					
88	36.0412	-4383.3	-4411.4	92.47					
89	35.8901	-4327.7	-4355.9	93.10					
90	35.7379	-4272.0	-4300.3	93.72					

• PHASE CHANGE

## 10.00 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
161	0.806578	4428.5	3172.2	166.80	231	0.537524	6588.3	4703.2	177.96
162	0.800572	4460.6	3194.9	167.00	232	0.535050	6618.4	4724.6	178.09
163	0.794668	4492.6	3217.5	167.20	233	0.532600	6648.6	4746.1	178.22
164	0.788864	4524.6	3240.1	167.39	234	0.530173	6678.7	4767.5	178.35
165	0.783156	4556.5	3262.6	167.58	235	0.527770	6708.8	4788.9	178.48
166	0.777542	4588.3	3285.1	167.78	236	0.525390	6738.9	4810.3	178.60
167	0.772019	4620.1	3307.6	167.97	237	0.523032	6769.0	4831.7	178.73
168	0.766585	4651.9	3330.1	168.16	238	0.520696	6799.1	4853.1	178.86
169	0.761237	4683.6	3352.5	168.35	239	0.518382	6829.2	4874.5	178.98
170	0.755973	4715.2	3374.8	168.53	240	0.516040	6859.3	4895.9	179.11
171	0.750791	4746.8	3397.2	168.72	241	0.513818	6889.4	4917.3	179.23
172	0.745689	4778.4	3419.5	168.90	242	0.511568	6919.4	4938.7	179.36
173	0.740664	4809.9	3441.8	169.08	243	0.509338	6949.5	4960.1	179.48
174	0.735714	4841.3	3464.0	169.27	244	0.507128	6979.5	4981.4	179.61
175	0.730839	4872.7	3486.3	169.45	245	0.504939	7009.5	5002.8	179.73
176	0.726035	4904.1	3508.5	169.62	246	0.502769	7039.6	5024.2	179.85
177	0.721301	4935.4	3530.6	169.80	247	0.500619	7069.6	5045.5	179.97
178	0.716636	4966.7	3552.8	169.98	248	0.498487	7099.6	5066.9	180.09
179	0.712038	4998.0	3574.9	170.15	249	0.496375	7129.6	5088.3	180.22
180	0.707505	5029.2	3597.0	170.33	250	0.494281	7159.6	5109.6	180.34
181	0.703035	5060.4	3619.1	170.50	251	0.492206	7189.6	5131.0	180.46
182	0.698628	5091.5	3641.1	170.67	252	0.490149	7219.6	5152.3	180.57
183	0.694282	5122.6	3663.2	170.84	253	0.488110	7249.6	5173.7	180.69
184	0.689995	5153.7	3685.2	171.01	254	0.486088	7279.6	5195.0	180.81
185	0.685765	5184.8	3707.2	171.18	255	0.484084	7309.5	5216.3	180.93
186	0.681593	5215.8	3729.1	171.35	256	0.482096	7339.5	5237.7	181.05
187	0.677476	5246.8	3751.1	171.51	257	0.480126	7369.5	5259.0	181.16
188	0.673414	5277.7	3773.0	171.68	258	0.478173	7399.4	5280.4	181.28
189	0.669405	5308.6	3794.9	171.84	259	0.476236	7429.4	5301.7	181.40
190	0.665447	5339.5	3816.8	172.01	260	0.474315	7459.3	5323.0	181.51
191	0.661541	5370.4	3838.7	172.17	261	0.472410	7489.3	5344.4	181.63
192	0.657684	5401.2	3860.6	172.33	262	0.470521	7519.2	5365.7	181.74
193	0.653877	5432.0	3882.4	172.49	263	0.468648	7549.1	5387.0	181.85
194	0.650117	5462.8	3904.2	172.65	264	0.466790	7579.1	5408.3	181.97
195	0.646403	5493.6	3926.0	172.81	265	0.464948	7609.0	5429.7	182.08
196	0.642736	5524.3	3947.8	172.96	266	0.463120	7638.9	5451.0	182.19
197	0.639114	5555.0	3969.6	173.12	267	0.461308	7668.8	5472.3	182.31
198	0.635535	5585.7	3991.3	173.27	268	0.459510	7698.8	5493.6	182.42
199	0.632000	5616.4	4013.1	173.43	269	0.457726	7728.7	5514.9	182.53
200	0.628507	5647.0	4034.8	173.58	270	0.455957	7758.6	5536.3	182.64
201	0.625056	5677.6	4056.5	173.74	271	0.454202	7788.5	5557.6	182.75
202	0.621646	5708.2	4078.2	173.89	272	0.452461	7818.4	5578.9	182.86
203	0.618275	5738.8	4099.9	174.04	273	0.450734	7848.3	5600.2	182.97
204	0.614943	5769.4	4121.6	174.19	274	0.449020	7878.2	5621.5	183.08
205	0.611651	5799.9	4143.3	174.34	275	0.447320	7908.1	5642.9	183.19
206	0.608395	5830.4	4164.9	174.49	276	0.445633	7938.0	5664.2	183.30
207	0.605177	5860.9	4186.6	174.63	277	0.443959	7967.9	5685.5	183.41
208	0.601995	5891.4	4208.2	174.78	278	0.442298	7997.8	5706.8	183.51
209	0.598849	5921.9	4229.8	174.93	279	0.440650	8027.6	5728.1	183.62
210	0.595738	5952.3	4251.5	175.07	280	0.439014	8057.5	5749.5	183.73
211	0.592662	5982.8	4273.1	175.22	281	0.437391	8087.4	5770.8	183.83
212	0.589619	6013.2	4294.6	175.36	282	0.435781	8117.3	5792.1	183.94
213	0.586610	6043.6	4316.2	175.50	283	0.434182	8147.2	5813.4	184.05
214	0.583633	6073.9	4337.8	175.65	284	0.432596	8177.1	5834.8	184.15
215	0.580688	6104.3	4359.3	175.79	285	0.431022	8206.9	5856.1	184.26
216	0.577775	6134.7	4380.9	175.93	286	0.429459	8236.8	5877.4	184.36
217	0.574893	6165.0	4402.4	176.07	287	0.427908	8266.7	5898.7	184.47
218	0.572041	6195.3	4424.0	176.21	288	0.426369	8296.6	5920.1	184.57
219	0.569219	6225.6	4445.5	176.35	289	0.424840	8326.5	5941.4	184.67
220	0.566427	6255.9	4467.0	176.48	290	0.423324	8356.3	5962.7	184.78
221	0.563664	6286.2	4488.5	176.62	291	0.421818	8386.2	5984.0	184.88
222	0.560929	6316.5	4510.0	176.76	292	0.420323	8416.1	6005.4	184.98
223	0.558222	6346.7	4531.5	176.89	293	0.418839	8446.0	6026.7	185.08
224	0.555543	6376.9	4553.0	177.03	294	0.417366	8475.8	6048.1	185.19
225	0.552891	6407.2	4574.5	177.16	295	0.415904	8505.7	6069.4	185.29
226	0.550265	6437.4	4596.0	177.30	296	0.414452	8535.6	6090.7	185.39
227	0.547666	6467.6	4617.4	177.43	297	0.413010	8565.5	6112.1	185.49
228	0.545093	6497.8	4638.9	177.56	298	0.411579	8595.3	6133.4	185.59
229	0.542545	6528.0	4660.3	177.70	299	0.410158	8625.2	6154.8	185.69
230	0.540022	6558.1	4681.8	177.83	300	0.408747	8655.1	6176.1	185.79

## 40.00 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
					91	35.7923	-4163.9	-4277.1	93.97
					92	35.6429	-4108.5	-4222.2	94.58
					93	35.4924	-4053.1	-4167.3	95.18
					94	35.3409	-3997.7	-4112.4	95.77
					95	35.1884	-3942.2	-4057.4	96.36
					96	35.0347	-3886.7	-4002.4	96.94
					97	34.8799	-3831.2	-3947.4	97.51
					98	34.7239	-3775.7	-3892.4	98.08
					99	34.5667	-3720.2	-3837.4	98.65
					100	34.4083	-3664.6	-3782.4	99.21
					101	34.2486	-3609.0	-3727.4	99.76
					102	34.0876	-3553.4	-3672.3	100.31
					103	33.9252	-3497.8	-3617.3	100.85
					104	33.7614	-3442.1	-3562.2	101.39
					105	33.5962	-3386.4	-3507.0	101.92
					106	33.4295	-3330.6	-3451.9	102.45
					107	33.2613	-3274.8	-3396.6	102.97
					108	33.0914	-3218.9	-3414.4	103.49
					109	32.9199	-3162.9	-3286.0	104.01
					110	32.7466	-3106.8	-3230.6	104.52
					111	32.5715	-3050.6	-3175.0	105.03
					112	32.3946	-2994.3	-3119.4	105.54
					113	32.2157	-2937.8	-3063.6	106.04
					114	32.0347	-2881.1	-3007.6	106.54
					115	31.8516	-2824.2	-2951.5	107.03
					116	31.6663	-2767.1	-2895.1	107.53
					117	31.4786	-2709.7	-2838.5	108.02
					118	31.2884	-2652.1	-2781.6	108.51
					119	31.0957	-2594.2	-2724.5	109.00
					120	30.9002	-2535.9	-2667.0	109.49
					121	30.7019	-2477.2	-2609.2	109.98
					122	30.5005	-2418.1	-2551.0	110.46
					123	30.2960	-2358.5	-2492.3	110.95
					124	30.0880	-2298.5	-2433.2	111.43
55	41.2510	-5867.4	-5965.6	70.76	125	29.8764	-2237.9	-2373.6	111.92
56	41.0268	-5842.1	-5940.9	71.21	126	29.6609	-2176.7	-2313.4	112.41
57	40.8176	-5814.3	-5913.5	71.71	127	29.4413	-2115.0	-2252.6	112.90
58	40.6214	-5783.9	-5883.7	72.23	128	29.2173	-2052.5	-2191.2	113.39
59	40.4360	-5751.3	-5851.6	72.79	129	28.9886	-1989.3	-2129.1	113.88
60	40.2598	-5716.6	-5817.3	73.37	130	28.7548	-1925.4	-2066.3	114.37
61	40.0913	-5680.0	-5781.1	73.98	131	28.5155	-1860.6	-2002.7	114.87
62	39.9292	-5641.5	-5743.0	74.60	132	28.2702	-1794.9	-1938.3	115.37
63	39.7724	-5601.4	-5703.3	75.25	133	28.0185	-1728.3	-1872.9	115.87
64	39.6200	-5559.8	-5662.1	75.90	134	27.7597	-1660.6	-1806.6	116.38
65	39.4711	-5516.8	-5619.5	76.57	135	27.4930	-1591.7	-1739.2	116.89
66	39.3252	-5472.5	-5575.5	77.25	136	27.2178	-1521.7	-1670.6	117.41
67	39.1815	-5427.0	-5530.4	77.93	137	26.9330	-1450.3	-1600.8	117.93
68	39.0397	-5380.4	-5484.2	78.62	138	26.6376	-1377.4	-1529.6	118.46
69	38.8993	-5332.8	-5437.0	79.31	139	26.3300	-1302.9	-1456.8	119.00
70	38.7600	-5284.4	-5389.0	80.01	140	26.0086	-1226.4	-1382.3	119.55
71	38.6214	-5235.2	-5340.1	80.71	141	25.6714	-1147.9	-1305.8	120.11
72	38.4833	-5185.2	-5290.5	81.41	142	25.3157	-1066.8	-1226.9	120.68
73	38.3456	-5134.5	-5240.2	82.11	143	24.9379	-982.8	-1145.3	121.27
74	38.2079	-5083.3	-5189.4	82.80	144	24.5335	-895.1	-1060.3	121.88
75	38.0702	-5031.5	-5138.0	83.50	145	24.0960	-803.0	-971.2	122.52
76	37.9323	-4979.3	-5086.1	84.19	147	23.0787	-599.2	-774.8	123.91
77	37.7941	-4926.6	-5033.8	84.88	148	22.4589	-481.9	-662.3	124.71
78	37.6555	-4873.5	-4981.2	85.56	148	21.7154	-347.7	-534.3	125.61
79	37.5165	-4820.1	-4928.2	86.24	148	21.1164	2420.6	1768.0	144.19
80	37.3769	-4766.4	-4874.9	86.92	149	20.7292	2422.2	1769.2	144.20
					150	20.6020	2560.0	1868.3	145.12
81	37.2368	-4712.5	-4821.3	87.59	151	20.59663	2674.2	1950.0	145.88
82	37.0959	-4658.3	-4767.5	88.26	152	20.38262	2774.0	2021.0	146.54
83	36.9544	-4603.9	-4713.5	88.91	153	20.20186	2864.0	2084.8	147.13
84	36.8121	-4549.3	-4659.4	89.57	154	20.04511	2946.6	2143.2	147.67
85	36.6690	-4494.5	-4605.1	90.22	155	20.90654	3023.5	2197.4	148.17
86	36.5251	-4439.7	-4550.6	90.86	156	20.78230	3095.9	2248.4	148.63
87	36.3804	-4384.7	-4496.1	91.49	157	20.66988	3164.7	2296.8	149.07
88	36.2348	-4329.6	-4441.4	92.12	158	20.56671	3230.4	2342.9	149.49
89	36.0882	-4274.4	-4386.7	92.75	159	20.47183	3293.4	2387.0	149.89
90	35.9408	-4219.2	-4331.9	93.36	160	20.38386	3354.1	2429.5	150.27

• PHASE CHANGE

## 40.00 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTHOPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTHROPY J/MOL-K
161	4.30187	3412.8	2470.6	150.63	231	2.27653	6191.7	4411.3	165.17
162	4.22509	3469.7	2510.4	150.99	232	2.26376	6225.3	4434.9	165.32
163	4.15292	3525.0	2549.1	151.33	233	2.25117	6258.9	4458.4	165.46
164	4.08483	3579.0	2586.7	151.66	234	2.23874	6292.4	4482.0	165.61
165	4.02039	3631.6	2623.5	151.98	235	2.22648	6325.9	4505.5	165.75
166	3.95925	3683.2	2659.4	152.29	236	2.21437	6359.3	4528.9	165.89
167	3.90108	3733.6	2694.6	152.59	237	2.20242	6392.6	4552.4	166.03
168	3.84562	3783.1	2729.2	152.89	238	2.19062	6425.9	4575.7	166.17
169	3.79263	3831.8	2763.1	153.18	239	2.17897	6459.2	4599.1	166.31
170	3.74191	3879.6	2796.4	153.46	240	2.16747	6492.4	4622.4	166.45
171	3.69327	3926.6	2829.2	153.73	241	2.15611	6525.5	4645.7	166.59
172	3.64656	3973.0	2861.5	154.00	242	2.14489	6558.6	4668.9	166.73
173	3.60164	4018.7	2893.4	154.27	243	2.13380	6591.6	4692.2	166.86
174	3.55838	4063.8	2924.8	154.53	244	2.12285	6624.6	4715.3	167.00
175	3.51666	4108.4	2955.8	154.78	245	2.11203	6657.6	4738.5	167.13
176	3.47639	4152.4	2986.5	155.03	246	2.10134	6690.4	4761.6	167.27
177	3.43747	4195.9	3016.8	155.28	247	2.09077	6723.3	4784.7	167.40
178	3.39981	4238.9	3046.8	155.52	248	2.08033	6756.1	4807.8	167.53
179	3.36335	4281.5	3076.5	155.76	249	2.07001	6788.8	4830.8	167.66
180	3.32801	4323.7	3105.8	156.00	250	2.05981	6821.6	4853.9	167.80
181	3.29373	4365.5	3135.0	156.23	251	2.04972	6854.2	4876.8	167.93
182	3.26045	4406.9	3163.8	156.46	252	2.03975	6886.9	4899.8	168.06
183	3.22812	4448.0	3192.4	156.68	253	2.02988	6919.5	4922.8	168.19
184	3.19669	4488.7	3220.8	156.90	254	2.02013	6952.0	4945.7	168.31
185	3.16611	4529.1	3249.0	157.12	255	2.01049	6984.5	4968.6	168.44
186	3.13633	4569.2	3276.9	157.34	256	2.00095	7017.0	4991.4	168.57
187	3.10733	4609.0	3304.7	157.55	257	1.99152	7049.5	5014.3	168.69
188	3.07907	4646.6	3332.2	157.76	258	1.98219	7081.9	5037.1	168.82
189	3.05151	4687.8	3359.6	157.97	259	1.97295	7114.3	5059.9	168.95
190	3.02461	4726.9	3386.8	158.18	260	1.96382	7146.6	5082.7	169.07
191	2.99836	4765.6	3413.8	158.38	261	1.95478	7178.9	5105.5	169.19
192	2.97271	4804.2	3440.7	158.58	262	1.94584	7211.2	5128.2	169.32
193	2.94766	4842.5	3467.5	158.78	263	1.93699	7243.4	5150.9	169.44
194	2.92317	4880.6	3494.0	158.98	264	1.92823	7275.6	5173.6	169.56
195	2.89922	4918.5	3520.5	159.17	265	1.91956	7307.8	5196.3	169.68
196	2.87578	4956.2	3546.8	159.37	266	1.91098	7340.0	5219.0	169.81
197	2.85285	4993.7	3573.0	159.56	267	1.90249	7372.1	5241.7	169.93
198	2.83039	5031.0	3599.0	159.75	268	1.89408	7404.2	5264.3	170.05
199	2.80839	5068.2	3625.0	159.93	269	1.88576	7436.2	5286.9	170.17
200	2.78684	5105.2	3650.8	160.12	270	1.87752	7468.3	5309.5	170.28
201	2.76572	5142.0	3676.5	160.30	271	1.86936	7500.3	5332.1	170.40
202	2.74501	5178.6	3702.1	160.48	272	1.86128	7532.3	5354.7	170.52
203	2.72470	5215.1	3727.6	160.66	273	1.85328	7564.2	5377.2	170.64
204	2.70478	5251.5	3753.0	160.84	274	1.84535	7596.2	5399.8	170.75
205	2.68523	5287.7	3778.3	161.02	275	1.83750	7628.1	5422.3	170.87
206	2.66603	5323.8	3803.5	161.20	276	1.82973	7660.0	5444.8	170.99
207	2.64719	5359.8	3828.7	161.37	277	1.82203	7691.8	5467.3	171.10
208	2.62868	5395.6	3853.7	161.54	278	1.81440	7723.7	5489.8	171.22
209	2.61050	5431.3	3878.7	161.71	279	1.80685	7755.5	5512.3	171.33
210	2.59264	5466.9	3903.6	161.88	280	1.79936	7787.3	5534.7	171.44
211	2.57508	5502.3	3928.4	162.05	281	1.79195	7819.0	5557.2	171.56
212	2.55782	5537.7	3953.1	162.22	282	1.78460	7850.8	5579.6	171.67
213	2.54085	5572.9	3977.7	162.39	283	1.77732	7882.5	5602.1	171.78
214	2.52415	5608.1	4002.3	162.55	284	1.77010	7914.2	5624.5	171.90
215	2.50773	5643.1	4026.8	162.71	285	1.76296	7945.9	5646.9	172.01
216	2.49158	5678.0	4051.3	162.88	286	1.75587	7977.6	5669.3	172.12
217	2.47568	5712.8	4075.7	163.04	287	1.74885	8009.2	5691.7	172.23
218	2.46003	5747.6	4100.0	163.20	288	1.74189	8040.9	5714.0	172.34
219	2.44462	5782.2	4124.3	163.35	289	1.73499	8072.5	5736.4	172.45
220	2.42945	5816.8	4148.5	163.51	290	1.72815	8104.1	5758.7	172.56
221	2.41451	5851.3	4172.6	163.67	291	1.72137	8135.7	5781.1	172.67
222	2.39979	5885.6	4196.7	163.82	292	1.71466	8167.2	5803.4	172.77
223	2.38530	5919.9	4220.7	163.98	293	1.70799	8198.8	5825.7	172.88
224	2.37101	5954.2	4244.7	164.13	294	1.70139	8230.3	5848.1	172.99
225	2.35693	5988.3	4268.7	164.28	295	1.69484	8261.8	5870.4	173.10
226	2.34305	6022.4	4292.5	164.43	296	1.68835	8293.3	5892.7	173.20
227	2.32937	6056.4	4316.4	164.58	297	1.68191	8324.8	5915.0	173.31
228	2.31588	6090.3	4340.2	164.73	298	1.67553	8356.3	5937.3	173.41
229	2.30258	6124.1	4363.9	164.88	299	1.66920	8387.7	5959.5	173.52
230	2.28947	6157.9	4387.6	165.03	300	1.66292	8419.1	5981.8	173.62

## 70.00 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
91	35.9899	-4110.7	-4307.7	93.63	92	35.8450	-4055.8	-4253.7	94.23
93	35.6993	-4000.9	-4199.5	94.82	94	35.5526	-3945.9	-4145.4	95.41
95	35.4051	-3891.0	-4091.3	95.99	96	35.2566	-3836.1	-4037.2	96.57
97	35.1072	-3781.1	-3983.2	97.14	98	34.9567	-3726.2	-3929.1	97.70
99	34.8053	-3671.3	-3875.1	98.26	100	34.6529	-3616.3	-3821.0	98.81
101	34.4994	-3561.4	-3767.0	99.36	102	34.3468	-3508.5	-3713.0	99.90
103	34.1891	-3451.6	-3659.1	100.43	104	34.0322	-3396.7	-3605.1	100.96
105	33.8742	-3341.8	-3551.2	101.49	106	33.7149	-3286.8	-3497.2	102.01
107	33.5545	-3231.9	-3443.3	102.52	108	33.3927	-3176.9	-3389.3	103.04
109	33.2296	-3121.9	-3335.3	103.54	110	33.0651	-3066.8	-3281.3	104.05
111	32.8993	-3011.6	-3227.2	104.55	112	32.7319	-2956.4	-3173.1	105.04
113	32.5631	-2901.1	-3118.9	105.53	114	32.3926	-2845.6	-3064.6	106.02
115	32.2206	-2790.1	-3010.2	106.51	116	32.0469	-2734.3	-2955.7	106.99
117	31.8714	-2678.4	-2901.0	107.47	118	31.6940	-2622.3	-2846.1	107.95
119	31.5148	-2566.0	-2791.1	108.42	120	31.3336	-2509.5	-2735.8	108.90
121	31.1504	-2452.6	-2680.3	109.37	122	30.9649	-2395.5	-2624.5	109.84
123	30.7773	-2338.0	-2568.5	110.31	124	30.5873	-2280.2	-2512.1	110.77
125	30.3948	-2222.0	-2455.4	111.24	126	30.1997	-2163.4	-2398.3	111.71
127	30.0019	-2104.4	-2340.8	112.18	128	29.8012	-2044.9	-2282.9	112.64
129	29.5975	-1984.9	-2224.5	113.11	130	29.3907	-1924.4	-2165.7	113.58
56	41.1148	-5789.8	-5962.3	70.83	61	40.1939	-5623.1	-5799.6	73.67
57	40.9088	-5760.7	-5934.1	71.34	62	40.0345	-5584.1	-5761.3	74.30
58	40.7155	-5729.3	-5903.5	71.89	63	39.8803	-5543.6	-5721.5	74.95
59	40.5331	-5695.8	-5870.8	72.46	64	39.7305	-5501.6	-5680.2	75.61
60	40.3597	-5660.4	-5836.1	73.05	65	39.5842	-5458.3	-5637.5	76.28
61	40.1939	-5623.1	-5799.6	73.67	66	39.4408	-5413.8	-5593.7	76.96
62	40.0345	-5584.1	-5761.3	74.30	67	39.2997	-5368.2	-5548.7	77.65
63	39.8803	-5543.6	-5721.5	74.95	68	39.1605	-5321.5	-5502.7	78.34
64	39.7305	-5501.6	-5680.2	75.61	69	39.0227	-5274.0	-5455.7	79.04
65	39.5842	-5458.3	-5637.5	76.28	70	38.8860	-5225.5	-5407.9	79.73
66	39.4408	-5413.8	-5593.7	76.96	71	38.7501	-5176.3	-5359.4	80.43
67	39.2997	-5368.2	-5548.7	77.65	72	38.6148	-5126.4	-5310.1	81.13
68	39.1605	-5321.5	-5502.7	78.34	73	38.4798	-5075.9	-5260.2	81.83
69	39.0227	-5274.0	-5455.7	79.04	74	38.3449	-5024.8	-5209.8	82.52
70	38.8860	-5225.5	-5407.9	79.73	75	38.2101	-4973.2	-5158.8	83.21
71	38.7501	-5176.3	-5359.4	80.43	76	38.0751	-4921.1	-5107.4	83.90
72	38.6148	-5126.4	-5310.1	81.13	77	37.9400	-4868.7	-5055.6	84.59
73	38.4798	-5075.9	-5260.2	81.83	78	37.8045	-4815.8	-5003.4	85.27
74	38.3449	-5024.8	-5209.8	82.52	79	37.6686	-4762.7	-4951.0	85.95
75	38.2101	-4973.2	-5158.8	83.21	80	37.5323	-4709.2	-4898.2	86.62
76	38.0751	-4921.1	-5107.4	83.90	81	37.3954	-4655.6	-4845.2	87.29
77	37.9400	-4868.7	-5055.6	84.59	82	37.2580	-4601.6	-4792.0	87.95
78	37.8045	-4815.8	-5003.4	85.27	83	37.1199	-4547.6	-4738.6	88.60
79	37.6686	-4762.7	-4951.0	85.95	84	36.9813	-4493.3	-4685.1	89.25
80	37.5323	-4709.2	-4898.2	86.62	85	36.8419	-4438.9	-4631.4	89.90
81	37.3954	-4655.6	-4845.2	87.29	86	36.7018	-4384.4	-4577.7	90.54
82	37.2580	-4601.6	-4792.0	87.95	87	36.5610	-4329.8	-4523.8	91.17
83	37.1199	-4547.6	-4738.6	88.60	88	36.4194	-4275.1	-4469.9	91.79
84	36.9813	-4493.3	-4685.1	89.25	89	36.2770	-4220.3	-4415.9	92.41
85	36.8419	-4438.9	-4631.4	89.90	90	36.1339	-4165.5	-4361.8	93.02
86	36.7018	-4384.4	-4577.7	90.54	87	36.0000	-4100.0	-4293.3	94.00
87	36.5610	-4329.8	-4523.8	91.17	88	35.8000	-4020.0	-4213.3	94.44
88	36.4194	-4275.1	-4469.9	91.79	89	35.1000	-3920.0	-4113.3	94.88
89	36.2770	-4220.3	-4415.9	92.41	90	34.4000	-3820.0	-3913.3	95.32
90	36.1339	-4165.5	-4361.8	93.02	91	33.7000	-3720.0	-3813.3	95.76

## 70.00 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
161	17.9066	711.5	315.4	131.46	231	4.21504	5779.2	4096.5	159.19
162	16.8630	904.6	484.0	132.65	232	4.18650	5817.3	4123.0	159.35
163	15.6987	1122.2	670.3	133.99	233	4.15846	5855.1	4149.5	159.51
164	14.4880	1355.6	866.1	135.42	234	4.13091	5892.8	4175.8	159.67
165	13.3478	1587.8	1056.4	136.83	235	4.10382	5930.4	4202.1	159.83
166	12.3611	1802.9	1229.1	138.13	236	4.07719	5967.9	4228.2	159.99
167	11.5435	1994.8	1380.3	139.28	237	4.05101	6005.2	4254.3	160.15
168	10.8719	2164.2	1511.8	140.30	238	4.02525	6042.4	4280.2	160.31
169	10.3155	2314.5	1626.9	141.19	239	3.99991	6079.4	4306.1	160.46
170	9.84745	2449.3	1729.0	141.98	240	3.97497	6116.3	4331.9	160.62
171	9.44741	2571.5	1820.7	142.70	241	3.95043	6153.1	4357.7	160.77
172	9.10042	2683.6	1904.2	143.35	242	3.92627	6189.8	4383.3	160.92
173	8.79547	2787.3	1980.9	143.95	243	3.90248	6226.4	4408.9	161.07
174	8.52443	2884.1	2052.0	144.51	244	3.87906	6262.9	4434.4	161.22
175	8.28114	2975.1	2118.6	145.03	245	3.85599	6299.2	4459.8	161.37
176	8.06091	3061.1	2181.2	145.52	246	3.83326	6335.5	4485.1	161.52
177	7.86008	3142.8	2240.4	145.99	247	3.81087	6371.6	4510.4	161.67
178	7.67577	3220.9	2296.8	146.43	248	3.78880	6407.7	4535.6	161.81
179	7.50566	3295.7	2350.7	146.85	249	3.76705	6443.6	4560.8	161.96
180	7.34787	3367.7	2402.4	147.25	250	3.74562	6479.5	4585.8	162.10
181	7.20086	3437.1	2452.1	147.63	251	3.72448	6515.3	4610.9	162.24
182	7.06336	3504.3	2500.1	148.00	252	3.70364	6550.9	4635.8	162.38
183	6.93429	3569.4	2546.5	148.36	253	3.68309	6586.5	4660.7	162.53
184	6.81275	3632.7	2591.5	148.70	254	3.66282	6622.0	4685.6	162.67
185	6.69797	3694.2	2635.3	149.04	255	3.64283	6657.5	4710.4	162.80
186	6.58929	3754.3	2677.9	149.36	256	3.62310	6692.8	4735.1	162.94
187	6.48613	3813.0	2719.4	149.68	257	3.60363	6728.1	4759.8	163.08
188	6.38801	3870.4	2760.0	149.98	258	3.58442	6763.2	4784.4	163.22
189	6.29447	3926.6	2799.7	150.28	259	3.56547	6798.3	4809.0	163.35
190	6.20516	3981.7	2838.6	150.57	260	3.54675	6833.4	4833.5	163.49
191	6.11972	4035.7	2876.7	150.85	261	3.52828	6868.3	4858.0	163.62
192	6.03786	4088.9	2914.1	151.13	262	3.51003	6903.2	4882.5	163.76
193	5.95930	4141.1	2950.9	151.40	263	3.49202	6938.0	4906.9	163.89
194	5.88383	4192.6	2987.1	151.67	264	3.47423	6972.8	4931.2	164.02
195	5.81121	4243.2	3022.7	151.93	265	3.45666	7007.5	4955.5	164.15
196	5.74125	4293.2	3057.7	152.18	266	3.43931	7042.1	4979.8	164.28
197	5.67379	4342.4	3092.3	152.44	267	3.42217	7076.6	5004.0	164.41
198	5.60866	4391.0	3126.4	152.68	268	3.40523	7111.1	5028.2	164.54
199	5.54572	4439.0	3160.0	152.92	269	3.38849	7145.6	5052.3	164.67
200	5.48484	4486.5	3193.3	153.16	270	3.37195	7179.9	5076.4	164.80
201	5.42589	4533.3	3226.1	153.39	271	3.35560	7214.3	5100.5	164.92
202	5.36877	4579.7	3258.6	153.63	272	3.33945	7248.5	5124.5	165.05
203	5.31338	4625.6	3290.7	153.85	273	3.32348	7282.7	5148.5	165.17
204	5.25962	4671.0	3322.5	154.07	274	3.30769	7316.9	5172.5	165.30
205	5.20741	4716.0	3353.9	154.29	275	3.29208	7351.0	5196.4	165.42
206	5.15667	4760.6	3385.1	154.51	276	3.27664	7385.0	5220.3	165.55
207	5.10732	4804.8	3416.0	154.73	277	3.26138	7419.0	5244.2	165.67
208	5.05930	4848.6	3446.6	154.94	278	3.24629	7453.0	5268.0	165.79
209	5.01254	4892.0	3476.9	155.14	279	3.23136	7486.9	5291.8	165.91
210	4.96699	4935.0	3507.0	155.35	280	3.21659	7520.7	5315.6	166.04
211	4.92258	4977.8	3536.9	155.55	281	3.20199	7554.5	5339.3	166.16
212	4.87927	5020.2	3566.5	155.75	282	3.18754	7588.3	5363.0	166.28
213	4.83701	5062.3	3595.9	155.95	283	3.17324	7622.0	5386.7	166.40
214	4.79576	5104.1	3625.1	156.15	284	3.15910	7655.6	5410.4	166.51
215	4.75546	5145.7	3654.1	156.34	285	3.14510	7689.2	5434.0	166.63
216	4.71609	5186.9	3683.0	156.53	286	3.13125	7722.8	5457.6	166.75
217	4.67760	5227.9	3711.6	156.72	287	3.11754	7756.4	5481.2	166.87
218	4.63996	5268.7	3740.0	156.91	288	3.10397	7789.9	5504.8	166.98
219	4.60314	5309.2	3768.3	157.10	289	3.09054	7823.3	5528.3	167.10
220	4.56710	5349.5	3796.4	157.28	290	3.07725	7856.7	5551.8	167.21
221	4.53182	5389.5	3824.4	157.46	291	3.06409	7890.1	5575.3	167.33
222	4.49726	5429.4	3852.2	157.64	292	3.05106	7923.5	5598.7	167.44
223	4.46341	5469.0	3879.9	157.82	293	3.03816	7956.8	5622.2	167.56
224	4.43023	5508.4	3907.4	157.99	294	3.02539	7990.0	5645.6	167.67
225	4.39770	5547.6	3934.8	158.17	295	3.01274	8023.3	5669.0	167.78
226	4.36580	5586.7	3962.0	158.34	296	3.00021	8056.5	5692.3	167.90
227	4.33451	5625.5	3989.1	158.51	297	2.98781	8089.7	5715.7	168.01
228	4.30381	5664.2	4016.1	158.68	298	2.97552	8122.8	5739.0	168.12
229	4.27368	5702.7	4043.0	158.85	299	2.96335	8155.9	5762.3	168.23
230	4.24409	5741.0	4069.8	159.02	300	2.95130	8189.0	5785.6	168.34

## 100.00 ATMOSPHERE ISOMAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
91	36.1784	-4056.7	-4336.7	93.30	92	36.0377	-4002.2	-4283.4	93.89
93	35.8962	-3947.7	-4230.0	94.48	94	35.7539	-3893.2	-4176.6	95.06
95	35.6109	-3838.8	-4123.3	95.64	96	35.4671	-3784.3	-4070.0	96.21
97	35.3224	-3729.9	-4016.7	96.77	98	35.1770	-3675.4	-3963.5	97.33
99	35.0306	-3621.1	-3910.3	97.88	100	34.8835	-3566.7	-3857.2	98.43
101	34.7354	-3512.4	-3804.1	98.97	102	34.5864	-3458.1	-3751.0	99.51
103	34.4365	-3403.8	-3698.0	100.04	104	34.2857	-3349.5	-3645.1	100.56
105	34.1338	-3295.3	-3592.1	101.08	106	33.9810	-3241.0	-3539.2	101.59
107	33.8272	-3186.8	-3486.4	102.10	108	33.6723	-3132.6	-3433.5	102.61
109	33.5164	-3078.4	-3380.7	103.11	110	33.3594	-3024.2	-3327.9	103.60
111	33.2012	-2969.9	-3275.1	104.09	112	33.0419	-2915.6	-3222.2	104.58
113	32.8813	-2861.2	-3169.4	105.06	114	32.7196	-2806.8	-3116.5	105.54
115	32.5566	-2752.3	-3063.5	106.02	116	32.3922	-2697.6	-3010.4	106.49
117	32.2265	-2642.9	-2957.3	106.96	118	32.0594	-2588.0	-2904.1	107.43
119	31.8909	-2533.0	-2850.7	107.89	120	31.7209	-2477.7	-2797.2	108.36
121	31.5493	-2422.3	-2743.5	108.82	122	31.3761	-2366.7	-2689.6	109.27
123	31.2013	-2310.8	-2635.5	109.73	124	31.0247	-2254.6	-2581.2	110.18
125	30.8464	-2198.2	-2526.7	110.64	126	30.6662	-2141.4	-2471.9	111.09
127	30.4841	-2084.4	-2416.8	111.54	128	30.3000	-2027.0	-2361.4	111.99
129	30.1138	-1969.2	-2305.7	112.44	130	29.9255	-1911.1	-2249.7	112.89
131	29.7348	-1852.5	-2193.3	113.34	132	29.5418	-1793.6	-2136.6	113.79
133	29.3464	-1734.2	-2079.5	114.23	134	29.1484	-1674.5	-2022.1	114.68
135	28.9477	-1614.3	-1964.3	115.13	136	28.7442	-1553.6	-1906.2	115.58
137	28.5377	-1492.6	-1847.6	116.02	138	28.3282	-1431.1	-1788.8	116.47
139	28.1154	-1369.1	-1729.5	116.92	140	27.8992	-1306.7	-1669.9	117.37
141	27.6794	-1243.9	-1610.0	117.81	142	27.4558	-1180.6	-1549.6	118.26
143	27.2283	-1116.8	-1488.9	118.71	144	26.9965	-1052.5	-1427.8	119.16
145	26.7603	-987.7	-1366.3	119.61	146	26.5195	-922.2	-1304.3	120.06
147	26.2737	-856.1	-1241.7	120.51	148	26.0226	-789.1	-1178.5	120.96
149	25.7659	-721.2	-1114.5	121.42	150	25.5033	-652.1	-1049.5	121.88
151	25.2343	-581.6	-983.1	122.35	152	24.9587	-508.9	-914.9	122.83
153	24.6758	-432.7	-843.3	123.33	154	24.3853	-353.0	-768.5	123.85
155	24.0866	-286.6	-707.3	124.28	156	23.7792	-210.2	-636.3	124.77
157	23.4625	-132.2	-564.1	125.27	158	23.1358	-52.6	-490.6	125.77
159	22.7984	28.8	-415.6	126.29	160	22.4496	112.1	-339.2	126.81

## 100.00 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
161	22.0887	197.5	-261.3	127.34	231	6.33450	5363.8	3764.2	154.85
162	21.7150	285.0	-181.6	127.88	232	6.28418	5406.8	3794.4	155.04
163	21.3278	374.9	-100.2	128.44	233	6.23492	5449.6	3824.4	155.22
164	20.9264	467.2	-17.0	129.00	234	6.18670	5492.1	3854.2	155.40
165	20.5193	562.1	68.1	129.58	235	6.13947	5534.3	3883.9	155.58
166	20.0793	659.8	155.1	130.17	236	6.09320	5576.3	3913.3	155.76
167	19.6334	760.2	244.1	130.77	237	6.04786	5618.0	3942.6	155.94
168	19.1730	863.5	335.0	131.39	238	6.00341	5659.5	3971.7	156.11
169	18.6992	969.6	427.7	132.02	239	5.95982	5700.9	4000.7	156.29
170	18.2136	1078.3	521.9	132.66	240	5.91707	5741.9	4029.5	156.46
171	17.7187	1189.4	617.5	133.31	241	5.87512	5782.8	4058.1	156.63
172	17.2176	1302.5	714.0	133.97	242	5.83395	5823.5	4086.6	156.80
173	16.7142	1417.2	811.0	134.63	243	5.79354	5864.0	4115.0	156.96
174	16.2128	1532.8	907.8	135.30	244	5.75386	5904.3	4143.2	157.13
175	15.7180	1648.7	1004.0	135.96	245	5.71489	5944.4	4171.3	157.29
176	15.2341	1764.1	1099.0	136.62	246	5.67660	5984.3	4199.3	157.46
177	14.7650	1878.4	1192.2	137.27	247	5.63898	6024.1	4227.1	157.62
178	14.3138	1991.0	1283.1	137.90	248	5.60201	6063.6	4254.9	157.78
179	13.8828	2101.4	1371.6	138.52	249	5.56566	6103.1	4282.5	157.94
180	13.4734	2209.2	1457.2	139.12	250	5.52992	6142.3	4310.0	158.09
181	13.0862	2314.1	1539.8	139.70	251	5.49477	6181.4	4337.3	158.25
182	12.7214	2415.9	1619.4	140.27	252	5.46020	6220.4	4364.6	158.40
183	12.3782	2514.7	1696.1	140.81	253	5.42618	6259.2	4391.8	158.56
184	12.0560	2610.3	1769.8	141.33	254	5.39271	6297.8	4418.9	158.71
185	11.7535	2702.8	1840.7	141.83	255	5.35977	6336.4	4445.8	158.86
186	11.4695	2792.3	1908.9	142.31	256	5.32733	6374.8	4472.7	159.01
187	11.2027	2879.1	1974.6	142.78	257	5.29540	6413.0	4499.5	159.16
188	10.9520	2963.1	2037.9	143.22	258	5.26396	6451.1	4526.2	159.31
189	10.7160	3044.6	2099.0	143.66	259	5.23298	6489.1	4552.8	159.46
190	10.4936	3123.6	2158.0	144.07	260	5.20247	6527.0	4579.3	159.60
191	10.2837	3200.4	2215.1	144.48	261	5.17241	6564.8	4605.8	159.75
192	10.0853	3275.1	2270.4	144.87	262	5.14279	6602.4	4632.1	159.89
193	9.89751	3347.8	2324.1	145.25	263	5.11359	6640.0	4658.4	160.03
194	9.71946	3418.7	2376.2	145.61	264	5.08481	6677.4	4684.6	160.18
195	9.55038	3487.8	2426.8	145.97	265	5.05644	6714.7	4710.8	160.32
196	9.38960	3555.3	2476.1	146.31	266	5.02846	6751.9	4736.8	160.46
197	9.23647	3621.2	2524.2	146.65	267	5.00087	6789.0	4762.8	160.60
198	9.09042	3685.8	2571.1	146.97	268	4.97366	6826.0	4788.7	160.73
199	8.95094	3749.0	2616.9	147.29	269	4.94682	6862.9	4814.6	160.87
200	8.81755	3810.9	2661.7	147.60	270	4.92034	6899.7	4840.3	161.01
201	8.68982	3871.6	2705.6	147.91	271	4.89421	6936.4	4866.1	161.14
202	8.56737	3931.3	2748.6	148.20	272	4.86842	6973.0	4891.7	161.28
203	8.44983	3989.9	2790.7	148.49	273	4.84297	7009.6	4917.3	161.41
204	8.33688	4047.5	2834.1	148.77	274	4.81785	7046.0	4942.8	161.55
205	8.22824	4104.1	2872.7	149.05	275	4.79306	7082.4	4968.3	161.68
206	8.12361	4159.9	2912.6	149.32	276	4.76857	7118.6	4993.7	161.81
207	8.02277	4214.9	2951.9	149.59	277	4.74440	7154.8	5019.1	161.94
208	7.92547	4269.0	2990.5	149.85	278	4.72053	7190.9	5044.4	162.07
209	7.83152	4322.4	3028.6	150.11	279	4.69695	7227.0	5069.7	162.20
210	7.74071	4375.1	3066.1	150.36	280	4.67366	7262.9	5094.9	162.33
211	7.65288	4427.1	3103.1	150.60	281	4.65065	7298.8	5120.0	162.46
212	7.56785	4478.5	3139.6	150.85	282	4.62792	7334.6	5145.1	162.58
213	7.48547	4529.3	3175.6	151.09	283	4.60546	7370.4	5170.2	162.71
214	7.40561	4579.4	3211.2	151.32	284	4.58327	7406.0	5195.2	162.84
215	7.32813	4629.1	3246.3	151.55	285	4.56133	7441.6	5220.2	162.96
216	7.25291	4678.1	3281.1	151.78	286	4.53966	7477.1	5245.1	163.09
217	7.17984	4726.7	3315.4	152.00	287	4.51823	7512.6	5270.0	163.21
218	7.10881	4774.8	3349.4	152.23	288	4.49705	7548.0	5294.8	163.33
219	7.03974	4822.4	3383.1	152.44	289	4.47610	7583.3	5319.6	163.46
220	6.97251	4869.6	3416.4	152.66	290	4.45540	7618.6	5344.3	163.58
221	6.90706	4916.4	3449.4	152.87	291	4.43492	7653.8	5369.0	163.70
222	6.84330	4962.7	3482.0	153.08	292	4.41467	7689.0	5393.7	163.82
223	6.78115	5008.7	3514.4	153.29	293	4.39466	7724.0	5418.3	163.94
224	6.72055	5054.2	3546.5	153.49	294	4.37484	7759.1	5442.9	164.06
225	6.66143	5099.5	3578.3	153.69	295	4.35525	7794.1	5467.5	164.18
226	6.60372	5144.3	3609.9	153.89	296	4.33587	7829.0	5492.0	164.30
227	6.54737	5188.8	3641.2	154.09	297	4.31669	7863.8	5516.5	164.41
228	6.49232	5233.0	3672.3	154.28	298	4.29772	7898.7	5541.0	164.53
229	6.43853	5276.9	3703.2	154.47	299	4.27895	7933.4	5565.4	164.65
230	6.38594	5320.5	3733.8	154.66	300	4.26037	7968.1	5589.8	164.76

## 200.00 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
91	36.7536	-3872.1	-4423.4	92.27	92	36.6244	-3818.7	-4372.0	92.86
93	36.4947	-3765.4	-4320.7	93.43	94	36.3645	-3712.1	-4269.4	94.00
95	36.2338	-3658.8	-4218.1	94.57	96	36.1026	-3605.6	-4167.0	95.12
97	35.9710	-3552.5	-4115.9	95.67	98	35.8388	-3499.4	-4064.9	96.22
99	35.7062	-3446.5	-4014.0	96.76	100	35.5730	-3393.5	-3963.2	97.29
101	35.4393	-3340.7	-3912.5	97.81	102	35.3051	-3287.9	-3861.9	98.33
103	35.1704	-3235.2	-3811.4	98.85	104	35.0351	-3182.6	-3761.1	99.36
105	34.8994	-3130.1	-3710.8	99.86	106	34.7630	-3077.6	-3660.6	100.36
107	34.6261	-3025.2	-3610.5	100.85	108	34.4887	-2972.9	-3560.5	101.33
109	34.3507	-2920.6	-3510.6	101.82	110	34.2121	-2868.4	-3460.8	102.29
111	34.0730	-2816.3	-3411.0	102.76	112	33.9332	-2764.1	-3361.3	103.23
113	33.7929	-2712.0	-3311.7	103.70	114	33.6519	-2659.9	-3262.1	104.15
115	33.5103	-2607.8	-3212.6	104.61	116	33.3681	-2555.7	-3163.1	105.06
117	33.2253	-2503.6	-3113.6	105.51	118	33.0818	-2451.5	-3064.1	105.95
119	32.9376	-2399.3	-3014.5	106.39	120	32.7928	-2347.0	-2965.0	106.83
121	32.6473	-2294.6	-2915.4	107.26	122	32.5010	-2242.2	-2865.7	107.70
123	32.3541	-2189.6	-2816.0	108.12	124	32.2064	-2137.0	-2766.2	108.55
125	32.0580	-2084.2	-2716.3	108.98	126	31.9088	-2031.2	-2666.3	109.40
127	31.7589	-1978.1	-2616.2	109.82	128	31.6081	-1924.8	-2565.9	110.24
129	31.4566	-1871.3	-2515.6	110.65	130	31.3042	-1817.7	-2465.0	111.07
61	40.6114	-5374.4	-5873.4	72.40	131	31.1511	-1763.8	-2414.4	111.48
62	40.4622	-5333.2	-5834.1	73.07	132	30.9970	-1709.8	-2363.6	111.89
63	40.3181	-5290.8	-5793.5	73.75	133	30.8421	-1655.6	-2312.7	112.30
64	40.1782	-5247.4	-5751.8	74.43	134	30.6863	-1601.3	-2261.7	112.70
65	40.0417	-5202.9	-5709.1	75.12	135	30.5296	-1546.7	-2210.5	113.11
66	39.9081	-5157.6	-5665.4	75.82	136	30.3720	-1492.0	-2159.3	113.51
67	39.7768	-5111.3	-5620.8	76.51	137	30.2135	-1437.2	-2108.0	113.92
68	39.6474	-5064.2	-5575.4	77.21	138	30.0540	-1382.3	-2056.6	114.32
69	39.5194	-5016.4	-5529.2	77.91	139	29.8935	-1327.2	-2005.1	114.71
70	39.3927	-4967.9	-5482.4	78.61	140	29.7320	-1272.1	-1953.7	115.11
71	39.2668	-4918.8	-5434.9	79.30	141	29.5696	-1216.9	-1902.2	115.50
72	39.1416	-4869.1	-5386.9	80.00	142	29.4061	-1161.6	-1850.8	115.89
73	39.0169	-4818.9	-5338.3	80.69	143	29.2415	-1106.3	-1799.3	116.28
74	38.8926	-4768.3	-5289.3	81.38	144	29.0759	-1050.9	-1747.9	116.67
75	38.7684	-4717.2	-5243.9	82.06	145	28.9092	-995.6	-1696.6	117.05
76	38.6443	-4665.8	-5190.2	82.75	146	28.7415	-940.1	-1645.2	117.43
77	38.5202	-4614.0	-5140.1	83.42	147	28.5725	-884.5	-1593.8	117.81
78	38.3960	-4561.9	-5089.8	84.09	148	28.4025	-828.8	-1542.3	118.19
79	38.2717	-4509.6	-5039.2	84.76	149	28.2313	-772.8	-1490.6	118.56
80	38.1471	-4457.1	-4988.4	85.42	150	28.0590	-716.3	-1438.6	118.94
81	38.0223	-4404.4	-4937.4	86.08	151	27.8854	-659.2	-1385.9	119.32
82	37.8971	-4351.5	-4886.3	86.72	152	27.7107	-600.8	-1332.1	119.71
83	37.7717	-4298.5	-4835.0	87.37	153	27.5347	-539.7	-1275.7	120.11
84	37.6459	-4245.4	-4783.7	88.00	154	27.3575	-476.2	-1216.9	120.52
85	37.5197	-4192.2	-4732.3	88.63	155	27.1791	-427.0	-1172.7	120.84
86	37.3931	-4138.9	-4680.9	89.26	156	26.9994	-369.1	-1119.6	121.21
87	37.2661	-4085.6	-4629.4	89.87	157	26.8185	-310.8	-1066.4	121.58
88	37.1386	-4032.2	-4577.9	90.48	158	26.6363	-252.2	-1013.1	121.96
89	37.0107	-3978.8	-4526.4	91.09	159	26.4528	-193.4	-959.5	122.33
90	36.8824	-3925.4	-4474.9	91.68	160	26.2680	-134.4	-905.9	122.70

## 200.00 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTHOPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
161	26.0819	-75.0	-852.0	123.07	231	13.3785	4239.4	2724.6	145.38
162	25.8946	-15.4	-798.0	123.44	232	13.2612	4292.9	2764.8	145.61
163	25.7060	44.5	-743.9	123.81	233	13.1460	4346.1	2804.5	145.84
164	25.5161	104.7	-689.6	124.17	234	13.0331	4398.9	2844.0	146.06
165	25.3249	165.1	-635.1	124.54	235	12.9221	4451.4	2883.1	146.29
166	25.1324	225.8	-580.6	124.91	236	12.8133	4503.5	2921.9	146.51
167	24.9387	286.7	-525.9	125.27	237	12.7064	4555.2	2960.3	146.73
168	24.7438	347.9	-471.1	125.64	238	12.6015	4606.7	2998.5	146.94
169	24.5477	409.4	-416.1	126.00	239	12.4985	4657.8	3036.3	147.16
170	24.3504	471.1	-361.1	126.37	240	12.3973	4708.6	3073.9	147.37
171	24.1520	533.1	-306.0	126.73	241	12.2980	4759.0	3111.1	147.58
172	23.9525	595.4	-250.7	127.09	242	12.2005	4809.2	3148.1	147.79
173	23.7518	657.8	-195.4	127.46	243	12.1047	4859.0	3184.8	147.99
174	23.5502	720.5	-140.0	127.82	244	12.0106	4908.5	3221.2	148.20
175	23.3476	783.5	-84.5	128.18	245	11.9182	4957.7	3257.4	148.40
176	23.1441	846.7	-29.0	128.54	246	11.8274	5006.7	3293.2	148.60
177	22.9398	910.0	26.6	128.90	247	11.7382	5055.3	3328.9	148.80
178	22.7347	973.6	82.3	129.26	248	11.6505	5103.7	3364.3	148.99
179	22.5289	1037.4	137.9	129.61	249	11.5644	5151.8	3399.4	149.18
180	22.3225	1101.4	193.6	129.97	250	11.4797	5199.6	3434.3	149.38
181	22.1155	1165.6	249.2	130.33	251	11.3965	5247.2	3469.0	149.57
182	21.9081	1229.9	304.9	130.68	252	11.3147	5294.5	3503.4	149.75
183	21.7004	1294.4	360.5	131.03	253	11.2342	5341.5	3537.6	149.94
184	21.4925	1359.0	416.1	131.39	254	11.1552	5388.3	3571.6	150.12
185	21.2845	1423.8	471.6	131.74	255	11.0774	5434.9	3605.4	150.31
186	21.0765	1488.6	527.1	132.09	256	11.0009	5481.2	3639.0	150.49
187	20.8686	1553.6	582.4	132.43	257	10.9256	5527.2	3672.4	150.67
188	20.6609	1618.6	637.7	132.78	258	10.8516	5573.1	3705.6	150.85
189	20.4536	1683.6	692.8	133.13	259	10.7787	5618.7	3738.6	151.02
190	20.2468	1748.7	747.8	133.47	260	10.7070	5664.1	3771.4	151.20
191	20.0406	1813.9	802.6	133.81	261	10.6365	5709.3	3804.0	151.37
192	19.8352	1879.0	857.3	134.15	262	10.5670	5754.2	3836.4	151.54
193	19.6317	1944.1	911.7	134.49	263	10.4987	5799.0	3866.7	151.71
194	19.4272	2009.1	966.0	134.83	264	10.4314	5843.5	3900.8	151.88
195	19.2249	2074.1	1020.0	135.16	265	10.3651	5887.9	3932.7	152.05
196	19.0239	2139.0	1073.7	135.49	266	10.2998	5932.0	3964.5	152.22
197	18.8242	2203.8	1127.2	135.82	267	10.2355	5976.0	3996.1	152.38
198	18.6261	2268.5	1180.5	136.15	268	10.1722	6019.8	4027.5	152.55
199	18.4296	2333.0	1233.4	136.47	269	10.1099	6063.3	4058.8	152.71
200	18.2349	2397.4	1286.0	136.80	270	10.0484	6106.8	4090.0	152.87
201	18.0420	2461.5	1338.3	137.12	271	9.98789	6150.0	4121.0	153.03
202	17.8511	2525.5	1390.3	137.43	272	9.92822	6193.0	4151.8	153.19
203	17.6622	2589.3	1441.9	137.75	273	9.86940	6235.9	4182.6	153.34
204	17.4755	2652.8	1493.1	138.06	274	9.81142	6278.6	4213.1	153.50
205	17.2910	2716.0	1544.0	138.37	275	9.75427	6321.2	4243.6	153.66
206	17.1088	2779.0	1594.5	138.68	276	9.69791	6363.6	4273.9	153.81
207	16.9290	2841.7	1644.6	138.98	277	9.64235	6405.8	4304.1	153.96
208	16.7516	2904.1	1694.3	139.28	278	9.58755	6447.9	4334.2	154.11
209	16.5766	2966.2	1743.6	139.58	279	9.53351	6489.8	4364.1	154.26
210	16.4042	3027.9	1792.5	139.87	280	9.48020	6531.6	4394.0	154.41
211	16.2343	3089.3	1841.0	140.17	281	9.42761	6573.3	4423.7	154.56
212	16.0671	3150.4	1889.1	140.45	282	9.37573	6614.8	4453.3	154.71
213	15.9024	3211.2	1936.8	140.74	283	9.32453	6656.1	4482.8	154.86
214	15.7403	3271.5	1984.0	141.02	284	9.27402	6697.3	4512.1	155.00
215	15.5809	3331.5	2030.8	141.30	285	9.22416	6738.4	4541.4	155.15
216	15.4241	3391.1	2077.3	141.58	286	9.17495	6779.4	4570.6	155.29
217	15.2699	3450.4	2123.2	141.85	287	9.12638	6820.2	4599.7	155.43
218	15.1184	3509.3	2168.8	142.12	288	9.07843	6860.9	4628.6	155.57
219	14.9695	3567.7	2213.9	142.39	289	9.03109	6901.5	4657.5	155.71
220	14.8232	3625.8	2258.7	142.66	290	8.98434	6941.9	4686.3	155.85
221	14.6795	3683.5	2303.0	142.92	291	8.93818	6982.3	4715.0	155.99
222	14.5384	3740.9	2346.9	143.18	292	8.89260	7022.5	4743.6	156.13
223	14.3998	3797.8	2390.4	143.43	293	8.84757	7062.6	4772.1	156.27
224	14.2637	3854.3	2433.5	143.69	294	8.80310	7102.6	4800.5	156.40
225	14.1301	3910.5	2476.3	143.94	295	8.75917	7142.4	4828.8	156.54
226	13.9989	3966.3	2518.6	144.18	296	8.71576	7182.2	4857.0	156.67
227	13.8701	4021.6	2560.6	144.43	297	8.67288	7221.9	4885.2	156.81
228	13.7438	4076.6	2602.1	144.67	298	8.63050	7261.4	4913.3	156.94
229	13.6197	4131.3	2643.3	144.91	299	8.58862	7300.9	4941.3	157.07
230	13.4980	4185.5	2684.2	145.14	300	8.54724	7340.2	4969.2	157.20

## 300.00 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
58	41.3754	-5304.1	-6038.8	69.43	121	33.5246	-2647.7	-3521.2	101.63
59	41.2114	-5264.1	-6001.7	70.11	122	33.3950	-2597.0	-3473.6	102.09
60	41.0560	-5223.1	-5963.5	70.80	123	33.2650	-2546.3	-3425.2	102.54
61	40.9075	-5181.1	-5924.2	71.50	124	33.1347	-2495.7	-3378.8	102.98
62	40.7651	-5138.2	-5883.9	72.19	125	33.0040	-2445.2	-3331.5	103.43
63	40.6275	-5094.5	-5842.7	72.89	126	32.8730	-2394.6	-3284.3	103.86
64	40.4941	-5049.9	-5800.6	73.60	127	32.7416	-2344.1	-3237.1	104.30
65	40.3640	-5004.6	-5757.7	74.30	128	32.6098	-2293.6	-3190.0	104.73
66	40.2368	-4958.5	-5714.0	75.00	129	32.4777	-2243.1	-3142.9	105.15
67	40.1119	-4911.7	-5669.5	75.71	130	32.3453	-2192.6	-3095.9	105.58
68	39.9888	-4864.2	-5624.4	76.41	131	32.2124	-2142.1	-3048.8	105.99
69	39.8672	-4816.2	-5578.7	77.11	132	32.0792	-2091.5	-3001.8	106.41
70	39.7469	-4767.6	-5532.3	77.81	133	31.9457	-2040.9	-2954.7	106.82
71	39.6275	-4718.4	-5485.5	78.51	134	31.8117	-1990.2	-2907.6	107.23
72	39.5088	-4668.8	-5438.2	79.20	135	31.6774	-1939.4	-2860.4	107.64
73	39.3907	-4618.8	-5390.5	79.89	136	31.5427	-1888.5	-2813.2	108.05
74	39.2730	-4568.3	-5342.3	80.58	137	31.4076	-1837.5	-2766.0	108.45
75	39.1556	-4517.5	-5293.9	81.26	138	31.2721	-1786.5	-2718.6	108.85
76	39.0383	-4466.4	-5245.1	81.94	139	31.1362	-1735.3	-2671.2	109.25
77	38.9212	-4415.1	-5196.1	82.61	140	30.9999	-1684.0	-2623.8	109.65
78	38.8040	-4363.4	-5146.8	83.27	141	30.8632	-1632.6	-2576.3	110.04
79	38.6869	-4311.6	-5097.4	83.93	142	30.7262	-1581.1	-2528.7	110.43
80	38.5696	-4259.6	-5047.7	84.59	143	30.5887	-1529.4	-2481.0	110.82
81	38.4521	-4207.4	-4998.0	85.24	144	30.4509	-1477.7	-2433.3	111.21
82	38.3346	-4155.1	-4948.1	85.88	145	30.3126	-1425.9	-2385.6	111.59
83	38.2168	-4102.7	-4898.1	86.51	146	30.1739	-1374.1	-2337.8	111.98
84	38.0987	-4050.2	-4848.1	87.14	147	30.0349	-1322.1	-2290.0	112.36
85	37.9805	-3997.7	-4798.0	87.76	148	29.8954	-1270.2	-2242.2	112.73
86	37.8620	-3945.1	-4748.0	88.38	149	29.7555	-1218.2	-2194.5	113.11
87	37.7432	-3892.5	-4697.9	88.99	150	29.6153	-1166.3	-2146.8	113.48
88	37.6241	-3839.8	-4647.8	89.59	151	29.4746	-1114.3	-2099.3	113.85
89	37.5048	-3787.2	-4597.7	90.18	152	29.3335	-1062.4	-2051.8	114.22
90	37.3852	-3734.6	-4547.7	90.77	153	29.1921	-1010.6	-2004.4	114.58
					154	29.0502	-958.9	-1957.1	114.94
					155	28.9079	-907.2	-1910.0	115.30
					156	28.7653	-855.5	-1863.0	115.66
					157	28.6222	-803.9	-1816.0	116.01
					158	28.4788	-752.2	-1769.0	116.36
					159	28.3350	-700.4	-1722.0	116.71
					160	28.1908	-648.2	-1674.7	117.06

## 300.00 ATMOSPHERE ISOBAR

TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K	TEMP. K	DENSITY MOL/LITER	ENTHALPY J/MOL	INTERNAL ENERGY J/MOL	ENTROPY J/MOL-K
161	28.0463	-63.6	-1147.5	120.82	231	18.1043	3732.0	2052.9	140.41
162	27.9014	-10.1	-1099.6	121.15	232	17.9856	3783.5	2093.4	140.63
163	27.7561	43.6	-1051.6	121.48	233	17.8681	3835.0	2133.7	140.85
164	27.6105	97.3	-1003.7	121.81	234	17.7517	3886.2	2173.8	141.07
165	27.4645	151.1	-955.7	122.14	235	17.6364	3937.3	2213.7	141.29
166	27.3182	205.0	-907.7	122.46	236	17.5223	3988.2	2253.4	141.51
167	27.1716	259.0	-859.7	122.79	237	17.4093	4039.0	2292.9	141.72
168	27.0247	313.1	-811.7	123.11	238	17.2974	4089.6	2332.2	141.93
169	26.8775	367.3	-763.7	123.43	239	17.1867	4140.0	2371.3	142.15
170	26.7300	421.5	-715.7	123.75	240	17.0771	4190.3	2410.2	142.36
171	26.5823	475.8	-667.7	124.07	241	16.9686	4240.4	2449.0	142.56
172	26.4342	530.2	-619.7	124.39	242	16.8612	4290.3	2487.5	142.77
173	26.2860	584.7	-571.7	124.70	243	16.7550	4340.1	2525.8	142.98
174	26.1375	639.3	-523.8	125.02	244	16.6499	4389.7	2564.0	143.18
175	25.9887	693.9	-475.8	125.33	245	16.5459	4439.1	2601.9	143.38
176	25.8398	748.5	-427.9	125.64	246	16.4430	4488.4	2639.7	143.58
177	25.6908	803.2	-380.0	125.95	247	16.3412	4537.5	2677.3	143.78
178	25.5415	858.0	-332.1	126.26	248	16.2405	4586.4	2714.6	143.98
179	25.3921	912.8	-284.3	126.57	249	16.1409	4635.2	2751.9	144.18
180	25.2427	967.7	-236.5	126.87	250	16.0424	4683.7	2788.9	144.37
181	25.0931	1022.6	-188.8	127.18	251	15.9450	4732.2	2825.7	144.56
182	24.9434	1077.6	-141.1	127.48	252	15.8486	4780.4	2862.4	144.76
183	24.7937	1132.6	-93.4	127.78	253	15.7533	4828.5	2898.8	144.95
184	24.6440	1187.6	-45.9	128.08	254	15.6591	4876.4	2935.2	145.14
185	24.4943	1242.7	1.7	128.38	255	15.5659	4924.2	2971.3	145.32
186	24.3446	1297.8	49.1	128.68	256	15.4737	4971.7	3007.2	145.51
187	24.1949	1352.9	96.5	128.97	257	15.3826	5019.2	3043.0	145.69
188	24.0454	1408.0	143.8	129.27	258	15.2924	5066.4	3078.6	145.88
189	23.8959	1463.2	191.1	129.56	259	15.2033	5113.5	3114.1	146.06
190	23.7466	1518.4	238.2	129.85	260	15.1152	5160.5	3149.4	146.24
191	23.5975	1573.5	285.3	130.14	261	15.0281	5207.3	3184.5	146.42
192	23.4485	1628.7	332.3	130.43	262	14.9419	5253.9	3219.5	146.60
193	23.2998	1683.8	379.2	130.71	263	14.8567	5300.3	3254.3	146.78
194	23.1513	1739.0	426.0	131.00	264	14.7725	5346.7	3288.9	146.95
195	23.0032	1794.1	472.6	131.28	265	14.6892	5392.8	3323.4	147.13
196	22.8553	1849.3	519.2	131.56	266	14.6068	5438.8	3357.7	147.30
197	22.7078	1904.4	565.7	131.84	267	14.5254	5484.7	3391.9	147.47
198	22.5607	1959.4	612.0	132.12	268	14.4449	5530.4	3425.9	147.64
199	22.4139	2014.5	658.3	132.40	269	14.3653	5575.9	3459.8	147.81
200	22.2677	2069.5	704.4	132.68	270	14.2865	5621.3	3493.6	147.98
201	22.1219	2124.5	750.3	132.95	271	14.2087	5666.6	3527.2	148.15
202	21.9766	2179.4	796.2	133.22	272	14.1317	5711.7	3560.6	148.31
203	21.8318	2234.2	841.9	133.49	273	14.0556	5756.7	3593.9	148.48
204	21.6877	2289.1	887.4	133.76	274	13.9803	5801.5	3627.1	148.64
205	21.5441	2343.8	932.8	134.03	275	13.9059	5846.2	3660.2	148.81
206	21.4011	2398.5	978.1	134.30	276	13.8322	5890.7	3693.1	148.97
207	21.2588	2453.1	1023.2	134.56	277	13.7594	5935.1	3725.9	149.13
208	21.1172	2507.7	1068.2	134.82	278	13.6874	5979.4	3758.5	149.29
209	20.9763	2562.1	1113.0	135.09	279	13.6162	6023.5	3791.0	149.45
210	20.8361	2616.5	1157.6	135.34	280	13.5458	6067.5	3823.4	149.60
211	20.6968	2670.8	1202.1	135.60	281	13.4761	6111.4	3855.7	149.76
212	20.5582	2725.0	1246.4	135.86	282	13.4072	6155.1	3887.8	149.91
213	20.4204	2779.1	1290.5	136.11	283	13.3391	6198.7	3919.9	150.07
214	20.2835	2833.1	1334.4	136.37	284	13.2717	6242.2	3951.8	150.22
215	20.1474	2887.0	1378.2	136.62	285	13.2050	6285.6	3983.6	150.37
216	20.0123	2940.8	1421.8	136.87	286	13.1390	6328.8	4015.2	150.53
217	19.8780	2994.5	1465.2	137.12	287	13.0738	6371.9	4046.8	150.68
218	19.7447	3048.0	1508.4	137.36	288	13.0092	6414.9	4078.3	150.83
219	19.6124	3101.4	1551.5	137.61	289	12.9454	6457.8	4109.6	150.97
220	19.4810	3154.7	1594.3	137.85	290	12.8822	6500.5	4140.8	151.12
221	19.3506	3207.9	1637.0	138.09	291	12.8197	6543.2	4172.0	151.27
222	19.2212	3261.0	1679.5	138.33	292	12.7578	6585.7	4203.0	151.42
223	19.0928	3313.9	1721.8	138.57	293	12.6966	6628.1	4233.9	151.56
224	18.9655	3366.7	1763.8	138.80	294	12.6361	6670.4	4264.7	151.70
225	18.8392	3419.3	1805.7	139.04	295	12.5761	6712.6	4295.4	151.85
226	18.7140	3471.8	1847.4	139.27	296	12.5168	6754.6	4326.1	151.99
227	18.5899	3524.1	1888.9	139.50	297	12.4582	6796.6	4356.6	152.13
228	18.4668	3576.3	1930.2	139.73	298	12.4001	6838.5	4387.0	152.27
229	18.3449	3628.3	1971.3	139.96	299	12.3426	6880.2	4417.3	152.41
230	18.2240	3680.2	2012.2	140.18	300	12.2857	6921.9	4447.6	152.55